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November 15, 1982

Energy Research Abstracts

ABSTRACTS 55977-59104

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $4.50, foreign $5.65 per copy; annual cumulative index, domestic $7.00, foreign $8.75 per copy. The annual subscription price is $48.00 for domestic subscribers and $60.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign).

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Fossil Energy Update (FEU)

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Fusion Energy Update (CFU)

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB82-915300.

Geothermal Energy Update (GEU)

A monthly abstract journal devoted to information on the exploration and development of geothermal resources. Available as PB82-914700.

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A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB82-913400.

Nuclear Reactor Safety (NRS)

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Radioactive Waste Management (RWM)

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB82-902900.

INTERNATIONAL ENERGY PUBLICATIONS

Atomindex (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Coal Abstracts (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to catalog official DOE issue-and-policy documents, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

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ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign). The cumulative indexes will be available in microfiche form only. The microfiche may be purchased from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

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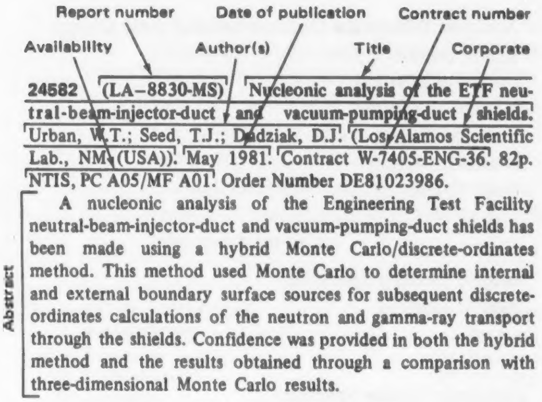
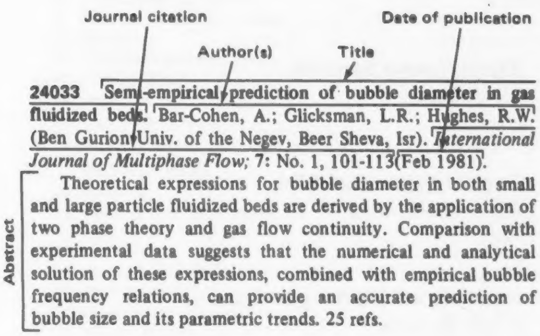
• ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.



24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). *International Journal of Multiphase Flow;* 7: No. 1, 101-113(Feb 1981).

Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

• INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033
Dudziak, D.J., *See* Urban, W.T., 6:24582
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Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles or informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
  Neutral Atom Beam Injection
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• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36 **Los Alamos National Lab., NM (USA)**
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• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number-Report Number Correlation is included for convenience.

LA– 8830-MS	6:24582	NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts.* The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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REFER ALSO TO CITATION(S) 56027, 56036, 56037, 56044, 56054, 56084, 56084, 56097, 56098, 56105, 56108, 56447, 56452, 56462, 56703, 57110, 57110, 57116, 57117, 57759, 57813, 58162

55977 (CONF-820557—2) Westinghouse gasification technology development and projects status. Daugherty, D.P.; Schmidt, D.K. (Westinghouse Electric Corp., Madison, PA (USA)). 1982. Contract AC21-82MC19122. 24p. NTIS, PC A02/MF A01. Order Number DE82016221.

From American Gas Association transmission conference; Chicago, IL, USA (17 May 1982).

A joint program between Westinghouse, the Department of Energy, and the Gas Research Institute has shown, through the use of a 35 ton-per-day coal feed process development unit (PDU), that the fluidized bed gasifier is technically feasible and economically attractive. The process has been shown to be simple, controllable, and safe in converting many types of coals, including reactive western coals, caking eastern coals, high ash coals, and run-of-mine coals. The process is efficient because it utilizes many coals at high conversion efficiency with relatively low use of oxidant and steam. Because of its simplicity, its use of available hardware technology, and the absence of tars in the product gas, the system has low capital and operating costs. It can be employed with little adverse environmental impact because of its efficiency, low pollutant output, low water usage, and disposal ash product. Process advantages have been confirmed by independent conceptual designs and cost estimates for commercial-scale applications, including substitute natural gas (SNG), industrial fuel gas, liquid synfuels, and combined cycle power generation. The development program includes unique cost-effective integration of hot and cold small-scale experimental models, a commercial-scale cold flow model, and analytical modeling, together with the PDU, to provide commercial design procedures. Westinghouse commercial designs are utilizing these design tools and the process is now being scaled-up for a commercial-scale demonstration facility.

55978 (DOE/ET/10154—103) Operation of the Wilsonville solvent-refined coal pilot plant: startup, calibration, and initial operation of the H-oil ebullated-bed hydrotreater unit. Technical evaluation. (Catalytic, Inc., Wilsonville, AL (USA)). Jul 1982. Contract AC22-76ET10154. 63p. NTIS, PC A04/MF A01. Order Number DE82019291.

This report presents initial operating data and analyses for the H-Oil Ebullated-Bed Hydrotreater (HTR) unit at the Wilsonville Solvent Refined Coal Pilot Plant in Wilsonville, Alabama. The focus of the report is on the initial period when the HTR unit operated with catalyst (May to June 1981). Additional data relates to the problems and adjustments during pre-operational testing (December 1980 to April 1981), solvent-SRC circulation testing (April to May 1981), and equipment repairs (July 1981). During the first two runs with catalyst (American Cyanamid HDS-1442B), the R1235 Reactor was operated at 756°F and 825°F. Equal amounts of hydrotreater solvent and deashed SRC were blended to make up the HTR unit feed. At these conditions, SRC conversion was 30 and 53%, respectively, and 82 and 88% of the sulfur was removed from the SRC feed. The total solvent yield was 26 and 39% of the SRC for the two temperatures, 756 and 825°F, respectively. Most of the preasphaltenes were converted (less than 0.5% in the solid product). Hydrogen consumption was estimated to be 3 to 4% of the feed SRC. The quality of the HTR solvent was evaluated in short and long microautoclave tests (80% and 80 to 88% THF conversion, respectively) and the values obtained were consistently higher than those for SRC unit solvent. It was noted that the HTR unit solvent gave higher results by the long test than the short test, whereas the opposite is true for SRC unit solvent.

55979 (DOE/ET/10237—1) Operation of the ash-agglomerating gasifier. July 1976-December 1977 and April 1979-July 1980, final report. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1982. Contract AC01-76ET10237. 63p. NTIS, PC A04/MF A01. Order Number DE82017217.

Under this program (DOE Contract No. DE-AC01-76ET10237), the Ash Agglomerating Gasifier (AAG) pilot plant was modified to facilitate extended tests with coal. Coal gasification tests were conducted on the modified AAG pilot plant. After successful coke shakedown tests, Montana subbituminous, washed Illinois No. 6 bituminous, washed and run-of-mine (ROM) Western Kentucky No. 9 bituminous, washed Pittsburgh seam bituminous, and washed Western Kentucky Nos. 9 and 11 mixed bituminous coals were processed. A total of 22 tests were conducted; 560 tons of coal were gasified and 780 hours of operation were logged. The following milestones were achieved: The AAG pilot plant was modified to accept raw coal feed. Direct feeding of raw bituminous coal (387 tons) to the gasifier eliminated the need for pretreatment before processing. Coal gasification under the steam-oxygen mode produced fuel gas having heating values up to 284 Btu/SCF. Coal conversion efficiencies up to 96% were attained when elutriated cyclone fines were recirculated to the reactor. Stable conditions for the ash agglomeration of washed and ROM Western Kentucky No. 9 bituminous, washed Pittsburgh seam bituminous, and washed Western Kentucky Nos. 9 and 11 mixed bituminous coals were confirmed. A complete documentation of the AAG pilot plant equipment history during the span of this program has been presented.

55980 (DOE/ET/10329—1211-Vol.1) Computer modeling of mixing and agglomeration in coal-conversion reactors. Volume I. Model formulation. Final report, September 15, 1978-February 28, 1982. Chan, R.K.C.; Chiou, M.J.; Dietrich, D.E.; Dion, D.R.; Klein, H.H.; Laird, D.H.; Levine, H.B.; Meister, C.A.; Scharff, M.F.; Srinivas, B. (JAYCOR, San Diego, CA (USA)). Feb 1982. Contract AC21-78ET10329. 125p. NTIS, PC A06/MF A01. Order Number DE82014836.

The FLAG code consists of the following major modules: Gas Flow (including Gas Turbulence), Gas-Phase Chemistry, Particle Dynamics and Energetics (including Particle Dispersion), Particle Chemistry (including devolatilization and heterogeneous reactions), Particle Collisions, Agglomeration, and Heat Transfer (conduction and radiation). These physical-chemical modules are embodied in computer subprograms. The distinction between a module and a subprogram is that the former is a conceptual division of the significant phenomena, whereas the latter is based on the ease of manipulation within the structure of the computer code. The basic solution procedure is a step-by-step integration of all the governing equations with respect to time, using a semi-implicit, second-order accurate, finite-difference scheme. In this procedure, the field variables, such as pressure, temperature, gas species concentration, velocity, etc. are evaluated at a finite set of spatial locations inside the reactor, as the time goes through a sequence of small, but finite increments. Thus, the evolution of the flow field is analogous to a sequential display of movie frames. To advance the state of the flow field by one time step, a series of calculations must be performed, involving the various modules described above. Figure 2-1 shows the flow chart of the basic computational procedure. Detailed descriptions of each module are given.

55981 (DOE/ET/11429—8) **Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Eighth quarterly report, June 15, 1980-September 15, 1980.** Katzer, J.R.; Stiles, A.B.; Kwart, H. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 1 Oct 1980. Contract AC22-78ET11429. 35p. NTIS, PC A03/MF A01. Order Number DE82020152.

Several catalysts have been prepared and tested with the emphasis on understanding the role of acidity in the carbon-nitrogen bond scission reaction. Hydrodenitrogenation of quinoline has been studied by using chlorided alumina catalysts. Preliminary results show a slight increase in nitrogen removal rate when chlorided versus unchlorided alumina supports are used. Experimental runs have also been made using 3.5% NiO/18% MoO_3 on $AlBO_3$ catalyst (prepared by co-precipitation). Even though the total nitrogen removal rates were same for the co-precipitated and standard HDS-9A catalyst, there is a reduction in the relative rate constants which require total hydrogenation prior to deamination.

55982 (DOE/ET/11429—9) **Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Ninth quarterly report, September 15, 1980-December 15, 1980.** Katzer, J.R.; Stiles, A.B.; Kwart, H. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 31 Dec 1980. Contract AC22-78ET11429. 40p. NTIS, PC A03/MF A01. Order Number DE82020154.

Portions of document are illegible.

Catalysts have been prepared and tested with the emphasis on understanding the role of catalyst support on the carbon-nitrogen bond scission reaction. Hydrodenitrogenation of quinoline has been studied using catalysts containing Ni-Mo on several different supports, such as alumina, fluorided alumina, magnesia and titania. Preliminary results from this study indicate that the nitrogen removal activity of titania-supported catalysts is significantly higher than those with alumina or magnesia supports. This difference in activity is probably due to a strong interaction between molybdenum and titania. The basic magnesium oxide catalyst shows very little hydrodenitrogenation activity when compared to an acidic support. Based on these results, we can speculate that the hydrogenolysis site may involve an acidic group adjacent to the transition metal ion on the surface of the catalyst and that the C-N bond scission reaction occurs via a Hoffman E-2 (β-elimination) process. Batch reactions of phenothiazine and an equimolar mixture of dibenzothiophene and acridine in the presence of sulfided $CoO\text{-}MoO_3/\gamma\text{-}Al_2O_3$ catalyst were performed at 573°K and 7000 kPa. Results show an increased rate of phenothiazine hydrodesulfurization (HDS) over that for dibenzothiophene. The presence of acridine inhibits HDS of dibenzothiophene. These results appear to be contradictory to a mechanism involving one-point sulfur site coordination, but can be explained in terms of a multipoint coordination of reactant Pi electrons with catalytic sites. A complete reaction network for the HDS and subsequent hydrodenitrogenation of phenothiazine is presented.

55983 (DOE/ET/11429—11) **Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Eleventh quarterly report, March 15, 1981-September 15, 1981.** Katzer, J.R.; Stiles, A.B.; Kwart, H. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 15 Oct 1981. Contract AC22-78ET11429. 35p. NTIS, PC A03/MF A01. Order Number DE82020143.

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Several catalysts have been prepared and tested with the emphasis on understanding the role of catalyst support on the carbon-nitrogen bond scission reaction. Hydrodenitrogenation of quinoline has been studied using catalysts containing Ni-Mo on titania-alumina support with different compositions. Preliminary results from these studies indicate that the 20% TiO_2/80% Al_2O_3 support leads to the most active catalyst. Based on these results, we can speculate that the hydrogenolysis site may involve an acidic group adjacent to a transition metal ion on the surface of the catalyst, and that the C-N bond scission reaction occurs via a Hoffman E-2 process. These results support the conclusion that the HDN activity increases with an increase in support acidity. Activated carbon (ME KOG) as a support was most recently evaluated and had a very inferior activity probably attributable both to surface (nonacidic) and pore (too small) characteristics.

55984 (DOE/ET/13108—81) **Underground gasification for steeply dipping coal beds: Phase III. Quarterly progress report, April 1-June 30, 1981.** (Gulf Research and Development Co., Pittsburgh, PA (USA); TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.). Dec 1981. Contract AC03-77ET13108. 133p. NTIS, PC A07/MF A01. Order Number DE82012927.

Portions of document are illegible.

Preparations are being made for the August start-up of Rawlins Test 2. Site construction activities began May 4 with the mobilization of the construction subcontractor. The drilling program was completed this quarter with the installation of instrumentation wells. The Experimental Basis Document, PGA Operating Manual, and DAS Operating Manual have also been completed.

55985 (DOE/METC—82-48) **Flash hydropyrolysis of coal for conversion to liquid and gaseous fuels.** Sundaram, M.S.; Steinberg, M.; Fallon, P.T. (Brookhaven National Lab., Upton, NY (USA)). May 1982. Contract AC02-76CH00016. 97p. NTIS, PC A05/MF A01. Order Number DE82019435.

Portions of document are illegible.

The overall objective of the short residence time flash hydropyrolysis/hydrogasification program is to obtain process chemistry and design information for production of both liquid and gaseous fuels from coal. In particular, the aim is to identify the products and to correlate the product yields as a function of pressure, temperature, and coal residence time in the flash hydropyrolyzer, and then to combine this information with the kinetic data to develop a reaction model. A parametric study of the flash hydropyrolysis has been made with different coal types. Appropriate reactor conditions for maximizing either liquid or gaseous products have been determined. The components in the heavier liquids have been identified, and nitrogen and sulfur balances were made on the coal, the char products, and both the liquid and the gaseous effluents. From a detailed analysis of data, a reaction scheme for the flash hydropyrolysis of coal was proposed, for which reaction rate constants were determined and a kinetic model was developed. All this information was applied to a conceptual full scale process design, and comparative economic estimates were made. The results indicate that the coals tested can be successfully converted to produce clean gaseous and liquid fuels via flash hydropyrolysis. Two features of this process - its being noncatalytic and its using direct hydrogenation in one step to liquid distillates - tend to improve the efficiency and reduce capital and operating costs. An important aspect of the process is its flexibility: it can be made to produce either gaseous or liquid fuels, or both, by adjusting the reactor and process design conditions.

55986 (DOE/OR/03054—6) **SRC-I quarterly technical report, October-December 1981.** (International Coal Refining Co., Allentown, PA (USA)). 1981. Contract AC05-78OR03054. 236p. NTIS, PC A11/MF A01. Order Number DE82018222.

Portions of document are illegible.

The SRC-I quarterly technical report for October to December 1981 contains 12 articles on various supporting research for the SRC-I 6000 tpd demonstration plant to be built at Newman, KY. All twelve articles have been entered individually into EDB and ERA. (LTN)

55987 (DOE/OR/03054—6, pp 1-7) **Trip report: offices of Gesellschaft fuer Kohle Technologie in Essen, West Germany.** Wilkins, J.T. (International Coal Refining Co., Allentown, PA); Reighard, R.C. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

During October 1981, four representatives of ICRC and one representative of the Ralph M. Parsons Co. (RMP) traveled to Gesellschaft fuer Kohle Technologie (GKT) in Essen, West Germany to discuss various aspects of the GKT gasification unit. Specifically, the trip was made to: review Kerr-McGee ash concentrate (K-MAC) bulk density and particle size test results, and discuss miscellaneous process-related topics concerning the GKT engineering package.

55988 (DOE/OR/03054—6, pp 17-24) **Technical and economic comparison of air and oxygen in activated sludge wastewater treatment.** 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

As part of the Phase I design effort for the SRC-I Demonstration Plant, a study was made to compare the technical and economic feasibility of using air or oxygen in an activated-sludge wastewater treatment system. The air system was chosen over the oxygen system because of the following reasons: the air system provides greater source reliability, and does not require generating equipment; the air system's completely mixed reactor is more stable, and provides a better dilution and damping effect on load fluctuations and toxic concentrations than the staged, plug-flow reactors required in an oxygen system (in addition, such staged reactors may be potentially unsafe if hydrocarbons are present); the uncovered air system prevents CO_2 accumulation in the vapor phase, thus eliminating CO_2 buildup, and consequently pH depression and inhibition; air system costs are approximately 11.6% per year less than oxygen system costs. The advantages of higher dissolved oxygen levels and consequently lower detention times, as well as the odor control offered by covered oxygen systems were not considered sufficient reasons to select oxygen over air.

55989 (DOE/OR/03054—6, pp 25-30) **Thermal conductivity data for Selexol/acid-gas mixtures.** Raman, S.V. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

In the SRC-I Demonstration Plant, the Selexol process will be used to remove H_2S and CO_2 from the makeup hydrogen stream. Thermal conductivity data on Selexol/Water/CO_2/H_2S mixtures were needed to confirm the design of several heat exchangers in this process. ICRC measured the thermal conductivity of a Selexol/water mixture, in contact with N_2, CO_2, and a CO_2/H_2S gas mixture, as a function of temperature (32 to 300°F). The data were needed to verify design of several heat exchangers in the Selexol process area of the SRC-I Demonstration Plant. Thermal conductivity, measured by the relative, transient hotwire technique, decreased with increasing temperatures in all three cases. However, thermal conductivity did not vary with changing gas composition or pressure. All the data were correlated by a single straight line.

55990 (DOE/OR/03054—6, pp 121-129) **Effect of accumulated solids on dissolver performance.** Garg, D.; Givens, E.N. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

Although no clear, concise data thoroughly establish the effects of accumulated solids upon dissolver performance, ICRC researchers hypothesize that, without the possible catalytic effects of these solids, the yields of lighter coal liquid products may decrease. If solids catalyze coal conversion by augmenting the reaction, then ICRC must quantify that effect to determine the dimensions and design of commercial dissolvers. ICRC researchers have been feeding solids into the continuously stirred tank reactor (CSTR) of the coal process development unit (CPDU). Filter cake and Kerr-McGee ash concentrate (K-MAC) from Wilsonville were added to the reaction mixture to simulate dissolver solids. Because the preceding studies were conducted in an open-loop, once-through, CSTR system (without recycling solvent), ICRC is uncertain about whether the same magnitude of catalysis from the accumulated solids will occur during closed-loop operation. In this type of operation, process solvent is recovered from the product and recycled until a constant solvent composition is achieved. Therefore, the following study was carried out to simulate the effect of accumulated solids on dissolver performance in a closed-loop system. Data from this study showed that coal conversion during a continuous, steady-state recycle run with SRC filter cake did not differ significantly between successive recycle passes. Oil production, SRC sulfur content, and hydrogen consumption, however, increased marginally in the second pass compared to the first. Finally, adding filter cake during coal liquefaction produced significantly higher oil yield in single pass and in steady-state recycle runs than in base-line runs without filter cake.

55991 (DOE/OR/03054—6, pp 131-143) **Developing methods for characterizing SRC-I solvent.** Lamb, S.C.; Schweighardt, F.K. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

Several critical variables affect the technology of SRC-I coal liquefaction. These variables include type, rank, and physical state of the feed coal, residence time in the reactor system, temperature, pressure of hydrogen gas, and properties of the recycled process solvent. The chemical composition and the properties of the process solvent. The chemical composition and the resultant properties of the process solvent are the variables that are the most critical and most difficult to control in the SRC-I process. The most important process solvent properties that affect coal liquefaction are the ability of the solvent to: physically suspend and dissolve coal, facilitate transfer of hydrogen from gaseous H_2 to the coal by cyclically hydrogenating and dehydrogenating the solvent, and facilitate transfer of hydrogen from one site to a different site within the coal matrix by cyclically hydrogenating and dehydrogenating the solvent. Material-balance data from the Wilsonville Pilot Plant in Alabama is being stored in the computer at International Coal Refining Company (ICRC). Programs now available will sort and correlate the data for solvent quality analysis. Manual analysis of the data showed that the quality of solvent tested in the Wilsonville microautoclave correlates strongly with the type of coal fed to the plant's liquefaction area. The microautoclave test, a microsimulation of coal liquefaction, is the most common solvent quality test in coal liquefaction. ICRC researchers have also begun a series of experiments to develop and review a catalytic dehydrogenation test for solvent quality.

55992 (DOE/OR/03054—6, pp 145-149) **Comparison of coal liquefaction yields obtained by solvent separation and distillation.** Garg, D.; Givens, E.N. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

In a continuation of Program 12.1.3, The Effect of Solvent IBP on Dissolver Performance, studies were carried out with two different initial boiling point (IBP) solvents to compare coal liquefaction yields. Yields were determined by both solvent separation and distillation analytical procedures. Solvent separation indicated higher oil production than did distillation. In addition, some variations in overall coal conversion were noted. No significant differences in oil production at a reaction temperature of 840°F were apparent with the two solvents, regardless of the analytical method used. However, with solvent separation, higher IBP solvent yielded oil production at 815°F. In addition, oil production with both solvents decreased considerably with lower reaction temperature. It can be concluded that solvent IBP does not affect dissolver performance at a higher reaction temperature, regardless of the analytical method used. However, oil production is very sensitive to reaction temperature, and is sensitive to solvent IBP at low reaction temperature.

55993 (DOE/OR/03054—6, pp 151-177) **LC-Finer product analysis.** Schweighardt, F.K. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

Incorporating the LC-Finer into the SRC-I Demonstration Plant will change plant operation considerably. Feeding deashed SRC to a catalytic hydroprocessing unit will require modifying the feed composition to prevent catalyst fouling, will increase the amount of hydrogen generation necessary, and will produce a major distillate product stream. Thus, materials in the feed that may contaminate the catalyst must be identified. The CE-Lummus Company conducted pilot plant runs in their LC-Finer to confirm the design basis for two operating modes under consideration for the demonstration plant. Run 2LCF-27 simulated the high-conversion operating mode, batch-recycling hydrotreated solvent and unconverted SRC. Run 2LCF-29 simulated the low-conversion mode, batch-recycling hydrotreated solvent only. Each run used Shell 324 catalyst and the same SRC and solvent (creosote oil/hydrotreated creosote oil) to start. This report summarizes and evaluates analyses performed by CE-Lummus and Conoco on the feeds to and products derived from both of these runs. Detailed observations about feed-blend composition and product distribution are given.

55994 (DOE/OR/03054—6, pp 179-200) **Development of SRC-I product analysis.** Kingsley, I.S.; Schweighardt, F.K. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

ICRC is conducting an experimental program to determine the most precise analytical procedures to include in the SRC-I Demonstration Plant analytical laboratory for process control and product characterization. These procedures must be well-established in order to develop a meaningful data base and to provide operational control during start-up and operation. Standardization of work-up methods therefore becomes of prime importance. Our work focused on both of these areas. We were able to duplicate Wilsonville's cresol solubility procedure, which will be used to determine the amount of residue in CPDU process-stream samples. Cresol-residue yield at ICRC can now be related to Wilsonville values within 3 to 5 wt %. We found that oil yields of a coal-liquefaction sample depend on the extraction solvent used. Because of polarity differences of the three solvents, the oil yield of an SRC sample increased from 3 to 5.5 to 11% using n-pentane, hexanes, and n-heptane, respectively. Oil yields of coal-liquefaction samples depend on the extraction solvent-to-sample ratio in the initial extraction step. The oil yield of a blend of SRC and heavy distillate was about 10% higher when the concentration of dissolved oils in the extracting solvent pentane increased above 0.02 g/mL. This limiting concentration must be considered in order to extract coal-liquefaction samples reliably and reproducibly. Residue yields of coal-liquefaction samples depend on the type of polar solvent used. Pyridine, cresol, tetrahydrofuran, and a methylene chloride/methanol mixture all gave different results. Our results show a strong dependence of residue yield on sample composition for each extracting solvent used.

55995 (DOE/OR/03054—6, pp 201-229) **Characterizing SRC-I products.** Cusick, R.C.; Slager, T.L.; Tiedge, W.F. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

To support ICRC studies of product uses, CRSD Analytical Services submitted this program. These studies will support product marketing, identify suitable end uses for SRC fuels, and determine the additional processing required to upgrade products to meet specifications for conventional products that these materials replace. This product characterization program also qualifies analytical procedures planned for use at the demonstration-plant analytical laboratory and provides a data base for future investigations of SRC fuel. The program determines the physical and chemical properties of SRC that are characteristic of materials which will be generated in the SRC-I Demonstration Plant to be constructed in Newman, Kentucky. The 6000-ton-per-day (tpd) demonstration plant is projected to generate 880 tpd of SRC and 100 tpd of second-stage or two-stage liquefaction (TSL) SRC, which represents about 30 wt % of the total product. Since these materials comprise a large proportion of the products generated by the plant, fully characterizing them is vital to selecting the most effective end-use markets. To explore the salability of SRC in potential markets such as fuel for oil/gas and oil-fired coal-designed boilers, furnaces, and kilns and as a specialty carbon product feedstock, these materials must be characterized by using analytical techniques common to each market. This report summarizes results from partial analyses of several samples.

55996 **(DOE/PC/30027—24) Recycle slurry-oil characterization. First annual report, October 1, 1980-September 30, 1981.** Burke, F.P.; Winschel, R.A. (Conoco Coal Development Co., Library, PA (USA). Research Div.). Jul 1982. Contract AC22-80PC30027. 151p. NTIS, PC A08/MF A01. Order Number DE82019358.

This work is similar in scope and intent to that completed under Contract DE-AC05-79ET-14503, Development of the Correlation Between Slurry Oil Composition and Process Performance. That contract was devoted to the analyses of slurry recycle oils from the H-Coal process development unit operated by HRI at Trenton, New Jersey. In the current contract the majority of samples will come from the two-stage liquefaction (TSL) bench scale unit operated by Lummus at New Brunswick, New Jersey. The Lummus unit consists of a short contact time coal liquefaction, followed by Lummus antisolvent deashing of the short residence time product. The deashed coal liquids are then upgraded in a Lummus-Cities Service LC-Fining unit. DOE will also provide samples from other sources for analysis under this contract notably the H-Coal PDU and the H-Coal pilot plant in Catlettsburg, Kentucky. Accomplishments for this period are reported under the following three tasks: analytical evaluation; analytical characterization; and data interpretation and reporting.

55997 **(DOE/PC/40273—T3) Effect of rapid heating rate on coal nitrogen and sulfur release. Quarterly technical progress report No. 3, March 19-June 19, 1982.** Gat, N. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA). Fluid Thermochemistry Dept.). 23 Jul 1982. Contract AC22-81PC40273. 21p. NTIS, PC A02/MF A01. Order Number DE82018593.

Several pyrolysis test series have been performed. Particle velocities have been measured using LDV and their temperature using a three-color pyrometer. Heating rates in the range of 10^5 to 10^6 K/s have been measured, final temperatures varied between 2100 to 2800°K. A significant enrichment in trace elements has been measured for samples with a relatively long residence time in the laser beam. The enrichment which is directly related to the residence time is used to obtain mass closure and nitrogen and sulfur release rates.

55998 **(DOE/PC/40799—T1) Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, October 1, 1981-December 31, 1981.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jul 1982. Contract FG22-81PC40799. 19p. NTIS, PC A02/MF A01. Order Number DE82018226.

In an attempt to identify some of the constituents in several coal liquefaction recycle solvents, HPLC coupled with Fourier Transform Infrared (FTIR) spectrometric detection has been employed in the normal phase affinity chromatographic (analytical scale) mode. FTIR offers many unique advantages as an LC detector. Most important for the application to LC are the rapid scan rates over large spectral regions which permit monitoring numerous wavelengths during a single chromatography run. This fact, coupled with signal averaging capability, computer assisted data collection, and manipulation and operator selected resolution, makes FTIR an unique LC detector with much potential. Several observations are noteworthy from the experimental data. First, the preliminary process solvent fractionation scheme precludes all heteroatom functionality from the non-polar portion. Hydrotreating process solvent definitely reduces its aromatic content. The composition across a single chromatographic peak can change substantially when dealing with complex mixtures. Identification of components by comparing retention times of models and unknowns can prove risky since considerable overlap between compounds of similar type has arisen. The added information from the IR detector should prove invaluable in fraction or compound identification. Finally, LC-IR data strongly support conclusions drawn from similar LC-NMR experiments. Both techniques together provide a powerful arsenal for organic complex mixture analysis.

55999 **(DOE/PC/40799—T2) Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, January 1, 1982-March 31, 1982.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Aug 1982. Contract FG22-81PC40799. 42p. NTIS, PC A03/MF A01. Order Number DE82019738.

One solution to the problems of analyzing coal liquids (wide polarity range-low heteroatom content) has been a preliminary preparative LC separation on silica into several fractions prior to analytical scale LC. This separation, which has been described previously, allows concentration of the more polar components (~ 20%

of the total) into several fractions. The polarity range of the components in each fraction is also limited which simplifies subsequent analysis under isocratic normal phase LC conditions. Given the simpler, more concentrated fractions, we have found that the samples, nevertheless, remain complex. Conventional modes of detection (UV, RI) continue to be relatively uninformative. Since we are interested in identifying the heteroatom containing species in recycle solvents, Fourier Transform Infrared Spectrometry (FTIR) appears to have great potential as a detection mode in this regard. Many heteroatom containing compounds exhibit characteristic absorbances in the infrared region, thereby making FTIR an extremely specific functionality detector. The rapid analysis time of FTIR makes it attractive as an LC detector and enables on-the-fly spectra to be obtained for compound identification. This report deals with the analysis of the Intermediate Polar fraction (heptane/20% $CHCl_3$-eluted) arising from the previously mentioned preparative separation of both a hydrogenated and non-hydrogenated process solvent by LC-FTIR employing a chemically bonded phase silica column and $CDCl_3$ elution.

56000 (DOE/PETC/TR—82/10) Study of the Fischer-Tropsch reaction using on-line gas-chromatographic analysis. Diffenbach, R.A.; Johnson, T.H.; Schehl, R.R. (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Energy Technology Center). Jul 1982. 37p. NTIS, PC A03/MF A01. Order Number DE82019142.

An on-line gas-chromatographic method was used to analyze the products obtained during the course of a Fischer-Tropsch reaction. The utility of this method for investigating catalyst activity and selectivity throughout the catalyst lifetime is illustrated. The variation in product composition with different reaction parameters has been demonstrated. The adherence of a classical Fischer-Tropsch iron catalyst to Anderson-Schulz-Flory kinetics can be illustrated under a variety of reaction conditions.

56001 (DOE/PETC/TR—82/13) Changes in chemical structure during coal liquefaction in PETC's 400 lb/day liquefaction unit. Lett, R.G.; Schmidt, C.E.; Finseth, D.H.; Retcofsky, H.L. (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Energy Technology Center). Jul 1982. 105p. NTIS, PC A06/MF A01. Order Number DE82018232.

Coal-derived materials from several experiments on the PETC 400 lb/day liquefaction unit have been investigated by spectroscopic techniques. Feed slurry and product components of a West Virginia (Ireland Mine) hvAb coal experiment were analyzed in detail to determine changes in structural parameters upon liquefaction of the coal. Mean structural units of the feed coal; coal extract; and oil, asphaltene, and pre-asphaltene fractions of the product are compared and discussed in terms of the mechanism of coal liquefaction. Free spin parameters of the feed coal and all solvent separated subfractions isolated from the liquefaction product were measured and interpreted in terms of liquefaction chemistry and the nature of the free radicals present. An analytical approach for estimating the net consumption of hydrogen during liquefaction by various mechanisms, based upon following the carbon through the reactor, is presented. To illustrate the potential application of this procedure, the relative amount of hydrogen consumed by hydrogenation, carbon-carbon bond rupture, and heteroatom elimination during liquefaction of West Virginia (Ireland Mine) hvAb coal has been calculated. Several products from the liquefaction of Western Kentucky (Homestead) hvBb coal were analyzed to investigate the removal of heteroatom components. Products from two related runs on the 400 lb/day unit, both in the presence and in the absence of an added Co-Mo/Al_2O_3 hydrodesulfurization catalyst, were studied to determine the effect of the catalyst and catalyst deactivation on the heteroatom distribution. A product sampled directly after passage through the preheater was analyzed to determine changes occurring prior to the reactor.

56002 (DOE/RA/20221—T1-Vol.1) Conceptual project study for anthracite coal gasification to produce fuels and chemicals, NEPGAS project. (Ebasco Services, Inc., New York (USA)). 1981. Contract FG01-79RA20221. 393p. NTIS, PC A17/MF A01. Order Number DE82009322.

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This project report summaries the work on the technical development and coal-derived fuels market assessment for the NEPGAS project. The scope of work completed under this authorization includes; site characterization, market assessment, technical development, capital investment, project economic assessment, and project recommendation and conclusions. As a result of this study it can be concluded that: it is technically feasible to make synthetic fuel (methanol) in an environmentally acceptable manner using anthracite as a respirce base; the methanol derived from anthracite is competitive with methanol derived from natural gas or oil and is rapidly approaching equity with imported fuels; methanol can be used as a combustion turbine fuel; the resources coal, water and site exist in Northeast Pennsylvania to support the plant; and there is sufficient combustion turbone peaking power capacity in the market area to consume the output of a 2500 tons per day methanol fuel plant.

56003 (MLM—2951(OP)) Instrumentation for optimizing an underground coal-gasification process. Seabaugh, P.W.; Zielinski, R.E. (Monsanto Research Corp., Miamisburg, OH (USA)). Jun 1982. Contract AC04-76DP00053. 8p. (CONF-820612—2). NTIS, PC A02/MF A01. Order Number DE82015843.

From Symposium on instrumentation and control for fossil energy processes; Houston, TX, USA (7 Jun 1982).

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While the United States has a coal resource base of 6.4 trillion tons only seven percent is presently recoverable by mining. The process of In-Situ Gasification can recover another twenty-eight percent of the vast resource. However, viable technology must be developed for effective in-situ recovery. The key to this technology is an instrumentation system that can optimize and control the process in real-time. This paper describes an instrumentation system that optimizes the composition of the injection gas, controls the in-situ process and conditions the product gas for maximum utilization. The key elements of this system are Monsanto PRISM Systems, a real-time analytical system, and a real-time data acquisition and control system. This system provides from complete automation of the process but can easily be overridden by manual control. The use of this cost effective system can provide process optimization and is an effective element in developing a viable in-situ technology.

56004 (MLM—2974-OP) In-situ coal gasification: a future source of energy. Agarwal, A.K.; Zielinski, R.E. (Mound Facility, Miamisburg, OH (USA)). 1981. Contract AC04-76DP00053. 6p. (CONF-810567—2). NTIS (US Sales Only). Order Number DE82019984.

From 64. chemical conference; Halifax, Nova Scotia, Canada (31 May 1981).

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An Underground Coal Gasification (UCG) field test in bituminous coal was successfully completed near Pricetown, West Virginia. A methane rich product gas with an average heating value of approximately 25 Btu/SCF (9315 KJ/M^3) was produced at low air injection flow rates during the reverse combustion linkage phase. The heating value of the gas produced during the linkage enhancement phase was 221 Btu/SCF (8230 KJ/M^3) with air injection. The high heating value of the gas was the combined effect of residence time, flow pattern, injection flow rate, injection pressure and back pressure. During the gasification phase, a gas with an average heating value of 125 Btu/SCF (4658 KJ/M^3) was produced with only air injection, which resulted in an average energy production of 362 MMBtu/day (382 GJ/day). The data obtained from this test are being used to design an effective program that will lead to a commercial demonstration and subsequently, commercial acceptance of this technology for bituminous coals by the early 1990's.

56005 (PB—82-156761) Synthetic fuels development in the Upper Colorado Region: section 13(a) water assessment report. Technical report. (Water Resources Council, Washington, DC (USA)). Jul 1981. 138p. NTIS, PC A07/MF A01.

The following general conclusions and major specific findings were reached during the course of the water assessment for the Upper Colorado Region. The production of synthetic fuels in the Upper Colorado River Region by the extraction and processing of oil shale and/or coal, will require significant quantities of water. The overall supply of ground and surface water resources in the Region is sufficient to accommodate a synfuels production level of nearly 3 million barrels oil equivalent per day. While the gross water supplies in the Region are sufficient for accelerated synfuels development, water supply problems are apparent in some areas.

56006 **(PB—82-159955) Process catalog for synfuel technologies in Texas.** (Camp Dresser and McKee, Inc., Austin, TX (USA)). Sep 1981. 158p. NTIS, PC A08/MF A01.

As an integral part of the overall 13a assessment process for Texas, this report was prepared to present specific information regarding the types of synfuel processes most likely to be developed in the state. Included is descriptive information for processes to gasify and liquefy coal and lignite and to convert biomass to usable fuels. Process flow diagrams and narrative descriptions, material and energy balances, water requirements and wastewater quantities and qualities are presented.

56007 **(PB—82-166539) Information and data for use in preparation of a criteria document for coke producing operations.** (American Iron and Steel Inst., Washington, DC). 1981. 81p. NTIS, PC A05/MF A01.

Work practices of coke oven workers are examined in order to find procedures to reduce exposures to coke oven emissions from coke producing operations. Evaluations were made of each job, the feasibility of the use of respirators, construction of filtered air and conditioned air booths, administrative controls, and general operating procedures. Because of widely varying coke plants in the United States, only general recommendations are made, among them some relating to the charging of coal, the coking of the coal charge and the pushing of coke. Other recommendations are: individual plant surveys to define local problem areas; engineering controls; definition of exposure time; and the abandonment of the coal tar pitch volatile standard of emission which is deemed not applicable to coke-oven emissions.

56008 **(PB—82-169095) Refining of coal-derived synthetic crudes. Technical report.** McGuckin, J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Feb 1982. 49p. NTIS, PC A03/MF A01.

This report examines the refining of coal-derived (H-Coal, EDS and SRC-II) synthetic crudes both alone in grass-roots refineries and in combination with petroleum crudes in existing refineries. The conclusions reached are as follows: The H-Coal syncrude is the cheapest to refine and the SRC-II syncrude is the most expensive. While the costs per mBtu of refining syncrudes in grass-roots or existing refineries is fairly close, the use of existing refineries will greatly reduce new capitol investment and appears to be the most likely scenario.

56009 **(PB—82-180621) Importance of active sites for char gasification in oxygen (air) and carbon dioxide. Annual report Oct 80-Sep 81.** Walker, P.L. Jr.; Jenkins, R.G.; Radovic, L.R. (Pennsylvania State Univ., University Park (USA)). Oct 1981. 53p. NTIS, PC A04/MF A01.

The reactivities of chars, obtained by rapid and slow pyrolysis of raw and suitably pretreated North Dakota lignite under widely varying conditions of temperature, heating rate and residence time, have been measured using thermogravimetric analysis. The pretreatment involved coal demineralization, ion exchange with ammonium acetate, and subsequently ion exchange with calcium acetate. In order to preserve the structure of the chars obtained by rapid pyrolysis, air was used as the reactant at low temperatures in the range 250 to 450C. Small amounts of sample (1-2 mg) were used in order to eliminate the effects of non-isothermal behavior and interparticle diffusional limitations on the observed kinetics. Major reactivity differences were observed as a function of pyrolysis residence time and the type of coal pretreatment used. These differences cannot be accounted for if the reactivities are normalized with respect to the total (CO2) surface areas of the chars. Catalysis of gasification by highly dispersed calcium was shown to be the predominant factor responsible for the high reactivity of the lignite chars.

56010 **(PB—82-180647) Microstructural study of failure mechanisms during mechanical testing in coal gasification environments. Annual report Mar 80-Feb 81.** Page, R.A. (Metal Properties Council, Inc., New York (USA)). Nov 1981. 50p. NTIS, PC A03/MF A01.

This annual progress report sets forth the program objectives and approach for a microstructural study of the behavior of iron-chromium-nickel alloys under the combined effects of stress and corrosive species encountered in coal gasification. The work involves systematic study of the effects of variations in alloy and environment compositions. Included are oxidizing and sulfidizing gas compositions. Model alloys have been procured and heat treated. In addition, microstructural changes which occur in 310 stainless steel, Incoloy 800H, RA 333 and IN 657 during stress rupture testing in a simulated coal gasification environment at 1500F have been examined. Optical metallography and energy dispersive X-ray analysis were used to characterize the microstructure. This characterization is continuing and a mechanism has been proposed.

56011 **(UCID—19273) Shaped-charge tests in support of the coal-gasification program.** Scheloske, R.F. (Lawrence Livermore National Lab., CA (USA)). Dec 1981. Contract W-7405-ENG-48. 14p. D. Order Number DE82007114.

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The LLNL concept for in-situ coal gasification requires forming horizontal holes in deep coal beds to connect vertical bore shafts. These lateral holes are required to provide a passage for the gases between the vertical shafts. Shaped charges are being considered for producing these horizontal bore holes. This report describes a test method for evaluating new shaped charge designs and presents the results for three designs.

56012 **(UCRL—87595) Thermodynamic limits to the quality of UCG product gas.** Creighton, J. (Lawrence Livermore National Lab., CA (USA)). 3 Aug 1982. Contract W-7405-ENG-48. 10p. (CONF-820840—5). NTIS, PC A02/MF A01. Order Number DE82020159.

From 8. underground coal conversion symposium; Keystone, CO, USA (15 Aug 1982).

The goal of this work was to find the limits placed on the quality of UCG product gas by the energy and mass balances, including atom balances. If the outlet gas contains no O_2, there are only two independent variables. If these are chosen to be the mass fractions, X/sub CO/ and X/sub H_2/, both the temperature of the outlet gas and the heat of combustion available by burning it are functions of these two variables only. The lines of constant temperature are parallel to the lines of constant heat of combustion, so it is clear that the available energy is partitioned between the sensible heat and the heat of combustion of the gas. The maximum heat available is set by the amount of oxygen in the inlet mixture; because the outlet temperature must exceed the minimum coal-surface temperature for burning, only heat losses within the system will generally reduce the heat of combustion. The maximum mass fractions of H_2 and CO in the product gas are limited by the impossibility of negative mass fractions of H_2O and CO_2. Additional limitations are imposed by the assumption of a minimum temperature. One of the two independent variables can be eliminated if the assumption of thermochemical equilibrium is valid. The product composition then lies on a single line in a phase plane of X/sub H_2/ vs X/sub CO/, and at a given outlet temperature the composition is fixed. Unfortunately, it appears that experimental values of X/sub H_2/ lie well above the equilibrium curve. Experimental data do indicate, however, that the system tends to operate near the minimum temperature to sustain the steam/char reaction on the coal surface, thus maximizing the heat of combustion of the outlet gas.

56013 **(UCRL—87611-Rev.1) Large block tests.** Thorsness, C.B.; Hill, R.W. (Lawrence Livermore National Lab., CA (USA)). Jul 1982. Contract W-7405-ENG-48. 19p. (CONF-820840—3-Rev.1). NTIS, PC A02/MF A01. Order Number DE82019432.

From 8. underground coal conversion symposium; Keystone, CO, USA (15 Aug 1982).

The five large block tests were planned as a series of gasification experiments that could be examined by postburn excavation at a fairly early stage of cavity development. The process of in situ coal gasification - while extremely simple in concept - is complicated in practice because, as the burn proceeds, the reacting volume is constantly changing geometry. In addition, the process takes place underground where it is extremely difficult to observe in detail. The experiments include 1:1 and 3:1 steam:oxygen injection at two different flow-rate schedules, an air-injection burn, and a test of the controlled retracing injection point (CRIP) system. The results of the tests indicate that the process is insensitive to changes in steam/oxygen ratios or flow rate over the range used. The burn cavities were all mostly filled with rubble and thermally altered coal.

56014 **(UCRL—87662) Review of underground coal-gasification field experiments at Hoe Creek.** Thorsness, C.B.; Creighton, J.R. (Lawrence Livermore National Lab., CA (USA)). 26 May 1982. Contract W-7405-ENG-48. 42p. (CONF-820610—8). NTIS, PC A03/MF A01. Order Number DE82015508.

From American Institute of Chemical Engineers' spring meeting; Anaheim, CA, USA (8 Jun 1982).

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LLNL has conducted three underground coal gasification experiments at the Hoe Creek site near Gillette, Wyoming. Three different linking methods were used: explosive fracture, reverse burning and directional drilling. Air was injected on all three experiments and a steam/oxygen mixture during 2 days of the second and most of the third experiment. Comparison of results show that the linking method didn't influence gas quality. The heat of combustion of the product gas was higher with steam/oxygen injection, mainly because of reduced inert diluent. Gas quality was generally independent of other operating parameters, but declined from its initial value over a period of time. This was due to heat loss to the wet overburden and extensive roof collapse in the second and third experiments.

56015 **(UCRL—87978) Examination of UCG cavities for the Large Block Test, Centralia, Washington.** Ramirez, A.L.; Wilder, D.G.; Pawloski, G.A. (Lawrence Livermore National Lab., CA (USA)). Jul 1982. Contract W-7405-ENG-48. 11p. (CONF-820840—4). NTIS, PC A02/MF A01. Order Number DE82020079.

From 8. underground coal conversion symposium; Keystone, CO, USA (15 Aug 1982).

This article describes general and specific characteristics of five underground coal gasification (UCG) cavities within the Big Dirty coal seam, Centralia, WA. The experiments involved both forward and reverse burns along drilled injection holes. Various mixtures of steam, oxygen, and air were injected into the seam. We have examined and photographed exposures of these cavities while the coal seam was sliced approximately every 1.5 m. Sixty-eight cavity exposures have been photographed, of which 26 were mapped in detail. We also present interpretations of these observations. Generally, the cavities were filled with dried coal, char, ash and slag, with open voids at the top of some. The ash and slag were always confined to the immediate vicinity of the injection borehole, and the cavities were taller than they were wide. Some cavity cross sections showed an abrupt widening of the sides of the char zone surrounding the cavity, which defined horizontal, finger-like margins a few metres long. These margins generally occurred near or between partings within the coal. The evidence suggests that the cavities primarily grew upwards. Where side growth was substantial, it was localized and strongly influenced by geologic structure. The bottoms of the cavities were bowl-shaped, while the roofs along the larger, well developed sections of the cavities were generally flat with approximately square corners. A significant void was observed in many cavities between the roof and the rubble filling the cavity. Although there were some differences between individual cavities, these were not clearly related to the various changes in gasification conditions performed during the burn.

56016 **Process for preparing a liquid fuel composition.** Singerman, G.M. (to Department of Energy). US Patent 4,319,981. 16 Mar 1982. Filed date 12 Nov 1980. vp.

PAT-APPL-205223.

A process for preparing a liquid fuel composition which comprises liquefying coal, separating a mixture of phenols from said liquefied coal, converting said phenols to the corresponding mixture of anisoles, subjecting at least a portion of the remainder of said liquefied coal to hydrotreatment, subjecting at least a portion of said hydrotreated liquefied coal to reforming to obtain reformate and then combining at least a portion of said anisoles and at least a portion of said reformate to obtain said liquid fuel composition.

56017 **Drilling right angle drainage holes in coal utilizing water jets.** Shoemaker, H.D.; Timmerman, K.M. *American Society of Mechanical Engineers,* [*Paper*]; No. 82-Pet-14, vp(Mar 1982).

The U.S. Department of Energy, in conjunction with Sandia National Laboratories, is developing a device utilizing high-pressure water jets to drill holes horizontally into coalbeds from a vertical wellbore. In drilling applications, the water jet drilling head is lowered on an articulated drill string, rotated to the horizontal at the coal seam, and advanced into the coal. 5 refs.

56018 **Rheological characterization of coal liquefaction preheater slurries.** Thurgood, J.R.; Hanks, R.W.; Oswald, G.E.; Youngblood, E.L. (Oak Ridge Natl Lab, Tenn, USA). *AIChE (American Institute of Chemical Engineers) Journal;* **28**: No. 1, 111-116(Jan 1982).

Rheological characterizations were made for a coal liquefaction preheater slurry; measurements were made in line at high temperature and high pressure. Above 400/degree/K, the coal-solvent slurry (35 wt.% coal) was pseudoplastic and was adequately modeled by a power-law equation. Experimental data over a temperature range of 400 to 700/degree/K were correlated, and critical slurry velocities for transition from laminar flow were calculated for flow in several pipe diameters. 15 refs.

56019 **Direct observations of devolatilizing pulverized coal particles in a combustion environment.** McLean, W.J.; Hardesty, D.R.; Pohl, J.H. (Sandia Lab, Livermore, CA). *Symposium (International) on Combustion,* [*Proceedings*]; 1239-1248(1981). (CONF-800809—).

From 18. combustion symposium; Waterloo, Canada (17 Aug 1980).

Direct observations of the early stages of combustion of size-graded (approximately 100 /mu/m) pulverized coal particles are reported. The particles are introduced on the centerline of a high temperature, transparent, laminar flow reactor fed by a gas fueled, premixed flat flame. Photographs of particle emission, high magnification shadowgraphs of burning particles, and micrographs of partially burnt captured material have been obtained. The ignition of both bituminous coal and lignite subjected to rapid heating (approximately 10/sup 5/ K/sec) by hot combustion products is characterized by bright diffuse emission attributed to burning of ejected volatile matter. Shadowgraphs and micrographs of burning bituminous coal indicate that, coincident with ignition, ejected volatile matter forms a condensed phase surrounding the particle. This study is pertinent to coal gasification. 29 refs.

56020 **Applications of reservoir simulation to in situ coal gasification.** Glass, R.E. (Sandia Natl Lab, Albuquerque, NM, USA). *In Situ;* **5**: No. 4, 265-277(1981).

This paper addresses the problem of the effect of nonuniform permeability on the air flow patterns in a water saturated coal seam. Specifically, the nonuniformities addressed are those caused by the existence of horizontal high permeability zones in an otherwise homogeneous, isotropic coal; the existence of anisotropic permeability; and the change in permeability caused by well completions. 11 refs.

56021 **Coal's future: a mining company's views.** Barker, S. Jr. pp 137-140 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

Why convert solid hydrocarbon materials like coal to synthetic liquids or gases. Why not burn them directly. We know that the direct combustion of coal to generate electricity is the most economical approach. However, in existing facilities, fuel forms are not readily interchangeable. Fuel storage and combustion equipment is typically designed for one fuel: gas, liquid, or solid. We have a large national capital investment in facilities to handle and burn liquid and gaseous fuels. Take natural gas, for example. The US has committed over $100 billion in utility, industry and consumer equipment that burns clean natural gas. Half of all the residences and commercial establishments in this country burn natural gas. The time lags and costs of changing fuels (for example, from gas to coal for power generation) would be great. As a result there are a number of technical and economic reasons for converting coal to liquids and gases. Coal is a versatile energy resource which may be burned directly to generate electric power, or converted to wide variety of gaseous and liquid fuels and feedstocks. Fuels include pipeline quality gas, methanol, gasoline, and fuel oil. Chemical feedstocks such as carbon monoxide may be produced from coal for further processing into a wide variety of chemicals. Through gasification and liquefaction, coal can be processed into fuel and feedstock forms which are compatible with existing industrial requirements. Through coal conversion, coal can play an increasingly important role in our national energy supply.

56022 **Synthetic fuels from coal. Part II.** Sinex, J.A. III. pp 153-171 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

To date, we have successfully completed the pilot operations in Westfield, Scotland. Electric Power Research Institute has had load following tests run on the Slagger with British Gas, and these confirmed that the Slagger is one of the most economical synthesis gas processes for combined-cycle electric power generation. A commercial plant design and economic evaluation study have been completed. The environmental assessment report has been completed, and the preliminary draft EIS is completed. No major problems are foreseen at this time. The plant site has been selected, in a sparsely populated area. It's near a good water source, and we're sitting on top of a 25-year supply of Ohio coal. We're also near pipeline distribution system. Texas Eastern has one of their main transmission lines passing through the area, and the East Ohio intrastate pipeline is very near to the plant also. There's plenty of area on this location for future expansion. The process design of the demonstration plant has been completed, and we're now preparing for a formal design review with DOE and the sub-contractors. The overall project schedule and manpower-usage are being controlled through a rather elaborate network analysis planning and control system.

56023 **Coal gasification: why and where do we stand.** Schlinger, W.G. (Texaco, Inc., Montebello, CA). pp 173-185 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The entrained bed gasifier offers a number of advantages, particularly when operating at temperatures above the fusion temperature of the coal ash. These advantages include the ability to process both caking and non-caking coal; delivery of a product gas free from tars and by-products; and high throughput and high carbon conversion, particularly at high pressure, because of the more rapid reaction rates. Entrained bed gasifiers involve bringing the oxidant and the coal into the gasifier in a concurrent manner, in contrast to the counterflow techniques used in the first two types of systems. These gasifiers may operate in either an upflow or downflow manner. The single stage, oxygen blown atmospheric pressure Koppers-Totzek gasifier is the only fully commerical entrained bed gasifier in operation today. The atmospheric pressure of this gasifier places it at an economic disadvantage for the majority of applications envisioned today. Most entrained bed gasifier developments involve pressurized reactors. A number of entrained bed gasifiers are undergoing development tests today in large pilot plants having a capacity on the order of 100 to 200 tons of coal per day. These include the single stage pressurized gasifier being developed by Shell and Koppers in Germany, the two stage Combustion Engineering gasifier, and the Department of Energy Bi-Gas gasifier in Pennsylvania. The above gasifiers all employ a dry coal feed system, whereas the downflow pressurized single stage Texaco gasifier, uses a slurry of coal in water as the feed.

56024 **Operation of the molten salt coal gasification process development unit.** Kohl, A.L.; Slater, M.H.; Hsia, P.R. (Rockwell Int). pp 759-773 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

This paper summarizes the results of test operations conducted on the Molten Salt Coal Gasification Process Development Unit (PDU). The work was performed by the Energy System Group of Rockwell International under a Department of Energy contract. In the Molten Salt Coal Gasification Process, coal is gasified by contacting it with air (or oxygen and steam) in a turbulent pool of molten sodium carbonate. The PDU was designed to process 1 ton per hour of coal at pressures up to 20 atm. It is a completely integrated facility including systems for feeding solids to the gasifier, regenerating sodium carbonate for reuse, and removing sulfur and ash in forms suitable for disposal.

56025 **(PB—82-183450) Solvent extraction of coal.** Pullen, J.R. (International Energy Agency Coal Research, London (UK)). [nd]. 127p. (ICTIS/TR—16). NTIS PC$18.00/MF$18.00.

Recent literature relating to solvent extraction of coal in connection with coal conversion technology is reviewed. Chemical and physical interactions between coal and solvents, particularly at elevated temperatures, and their significance in coal liquefaction and refining are discussed. Studies are described which have attempted to elucidate the fundamental mechanism of the conversion process. Other aspects considered include the effects of coal properties, catalytic effects of minerals in coal, methods used to evaluate solvents for liquefaction and properties of suitable solvents, methods of coal solubilization which may be useful in conversion, and supercritical gas extraction. Some processes which use solvent extraction techniques are briefly discussed. Many are at pilot plant stage and a few are planned to reach commercilization within the next few years. Despite this, the exact chemistry of the processes is not completely understood. (Copyright (c) 1981 IEA Coal Research.)

0105 By-products

REFER ALSO TO CITATION(S) 56046, 56051, 56184, 56185, 57284

0106 Properties

REFER ALSO TO CITATION(S) 55979, 55995, 55996, 55998, 56004, 56012, 56013, 56018, 56019, 56083, 57284, 57545, 57684, 58250, 58253

56026 **(DOE/MC/16221—T4) Investigation of coal devolatilization: kinetics and product characterization. Second quarterly report, 23 May 1981-23 August 1981.** Seery, D.J.; Freihaut, J.D. (United Technologies Research Center, East Hartford, CT (USA)). 1981. Contract AC21-81MC16221. 95p. NTIS, PC A05/MF A01. Order Number DE82003015.

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This report presents work performed in the second quarter of Contract DE-AC21-81MC16221 for an investigation of coal devolatilization. The objectives of this study are to determine the relationship between coal structure and devolatilization and the effects of heating rate, final temperature, ambient pressure and particle size on the devolatilization process. This report discusses elemental analysis results, techniques of structural characterization by infrared absorption, infrared analysis of samples and initial results of thermal devolatilization experiments performed with several coals.

56027 (DOE/OR/03054—6, pp 47-120) **SRC-I Demonstration Plant analytical laboratory.** Wood, K.A.; Slager, T.L.; Klusaritz, M.L. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

Effective demonstration plant operation will rely on monitoring process streams to provide data for process material balances and product quality control. Rapid, accurate analyses will be especially vital during commissioning or when operating conditions are being adjusted. Therefore, the plant's analytical laboratory must be running smoothly prior to plant commissioning. To achieve this goal, APCI is conducting an analytical program to identify sources that will be sampled, determine the size of the laboratory, select and evaluate the analytical tests, compile a methods manual, and assist in the selection and training of laboratory personnel. This report focuses on the following areas: an evaluation of the labor, space, and chemical-waste requirements of the laboratory; development of simulated distillation methods of analysis; determination of boiling points and specific gravities of SRC liquids; determination of metals in SRC products and related materials by energy-dispersive x-ray fluorescence (EDXRF); and development of qualitative and quantitative gas chromatographic/mass spectrometric (GC/MS) analyses of coal liquids.

56028 **(DOE/PC/41755—13) Nonstandard aging tests on coal-derived distillate fuels. Technical progress report, 7 January 1982-6 July 1982.** Bowden, J.N. (Southwest Research Inst., San Antonio, TX (USA)). 6 Aug 1982. Contract AC22-81PC41755. 11p. NTIS, PC A02/MF A01. Order Number DE82019078.

The objective is to evaluate the stability of coal-derived liquid fuels and to provide samples of aged synfuels and deposits formed during aging to the Pittsburgh Energy Technology Center (PETC) for detailed characterization. At the onset, PETC was to provide samples of these liquids for aging tests to be conducted at 43°C for 24 weeks. Aliquot samples would be taken at 4-week periods, analyzed for specific gravity, elemental composition, existent gum, adherent gum, and insoluble precipitate. Fifty mL samples would be forwarded to PETC under nitrogen blanket. Gum deposits, if formed in sufficient quantities, would also be forwarded. During the reporting period, 24-week aging procedures were completed on samples of H-coal naphtha and EDS middle distillate. Continuing tests with a blend of coal-derived and petroleum-based naphthas have completed 16 weeks and tests with a second EDS distillate obtained from UOP have completed 8 weeks. Test results are tabulated.

56029 **(NASA-TP—2014) Carbon-catalyzed oxidation of SO_2 by NO_2 and air.** Rogowski, R.S.; Schryer, D.R.; Cofer, W.R. III; Edahl, R.A. Jr.; Munavalli, S. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Apr 1982. 10p. (L—15214). NTIS, PC A02/MF A01.

A series of experiments was performed using carbon particles (commercial furnace black) as a surrogate for soot particles. Carbon particles were suspended in water, and gas mixtures were bubbled into the suspensions to observe the effect of carbon particles on the oxidation of SO2 by air and NO2. Identical gas mixtures were bubbled into a blank containing only pure water. After exposure each solution was analyzed for pH and sulfate. It was found that NO2 greatly enhances the oxidation of SO2 to sulfate in the presence of carbon particles. The amount of sulfate found in the blanks was significantly less. Under the conditions of these experiments no saturation of the reaction was observed and SO2 was converted to sulfate even in a highly acid medium (pH or 1.5).

56030 **Cross-polarization magic angle spinning /sup 13/C NMR spectra of coals of varying rank.** Miknis, F.P.; Sullivan, M.; Bartuska, V.J.; Maciel, G.E. (Laramie Energy Technol Cent, Wyo, USA). *Organic Geochemistry;* 3: No. 1-2, 19-28(Jan-Apr 1981).

Cross-polarization, magic-angle spinning /sup 13/C nuclear magnetic resonance spectra have been obtained on a series of coals that span the ASTM rank classification. Aromaticities thus obtained follow the classification reasonably well, increasing as rank increases. NMR parameters were extensively varied to determine optimum conditions for the cross polarization contact time and pulse repetition rate. Good correlations were obtained between both the fixed carbon and the volatile matter obtained from the proximate analysis, and the aromatic carbon obtained from NMR. Generally the NMR spectra of lignites and low rank coals exhibit varying degrees of fine structure. The method has a wide variety of potential applications to the study of fossil fuels, ranging from purely geochemical in nature to process technology and fuel utilization. Refs.

0108 Waste Management

REFER ALSO TO CITATION(S) 56048, 56053, 56059, 56101, 56102, 56722

56031 **(AD-A—109877/1) A procedure for determining the resource utilization potential of coal ash. Master's thesis.** Karasek, J.F. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1981. 140p. (AFIT-LSSR—58-81). NTIS, PC A07/MF A01.

A combination of the increased utilization of coal as an energy source and more stringent environmental regulations is creating problems for the disposal of the ash by-product from the combustion of coal. Utilization of the coal ash as an alternate resource has proven to be a partial solution to the problem. The U.S. Air Force coal conversion program will increase coal consumption and the production of coal ash; this has a potential to create a disposal problem for coal-burning bases. The purpose of this thesis was to develop a procedure to aid an engineer in determining the resource utilization potential of the coal ash at the base. The quality and quantity of the ash are the two main factors that affect the resource utilization potential of the ash. These two factors are a function of the nature of the feed coal, and the production, collection, handling, and storage systems utilized at the base. The procedure does not address the determination of the market potential of the ash, but rather its potential to be utilized as an alternate resource. The procedure provides a sequence of steps to follow in determining the resource utilization potential of a coal ash.

56032 **(DOE/ET/15492—T23) Laboratory/bench scale testing and evaluation of A.P.T. dry plate scrubber. Seventh quarterly progress report, September 1-November 30, 1981.** (Air Pollution Technology, Inc., San Diego, CA (USA)). 17 Dec 1981. Contract AC21-80ET15492. 18p. NTIS, PC A02/MF A01. Order Number DE82006789.

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The objective of this report is to conduct a bench scale experimental evaluation of the A.P.T. dry plate scrubber (DPS) at high temperature and pressure to determine its potential for controlling particulate and alkali vapor emissions from pressurized fluidized-bed combustion processes. This project is divided into two phases and seven major tasks. Phase I is a preliminary study consisting of a theoretical review, preliminary particle collection experiments and preliminary alkali sorption experiments. The purpose of Phase I is to provide specific design criteria for Phase II. Phase II is a bench scale evaluation of the DPS at high temperature (900°C) and pressure (1000 kPa). The bench scale DPS will be designed and evaluated for both particulate matter and alkali vapor control. The results will be used to develop an engineering design model for predicting the efficiency and power costs for the DPS. A detailed process design of a DPS sub-pilot plant installed at a PFBC facility will be made. The process economics will be evaluated in terms of capital and operating costs as a function of cleaning efficiency.

56033 **(DOE/FC/10120—T6) Hydrogeological and geotechnical procedures manual for western strip mine FGD sludge disposal. Quarterly technical progress report, March 1, 1982-May 31, 1982.** Manz, O.E.; Groenewold, G.H. (North Dakota Univ., Grand Forks (USA); North Dakota Geological Survey, Grand Forks (USA)). Jul 1982. Contract AB18-80FC10120. 12p. NTIS, PC A02/MF A01. Order Number DE82018248.

Progress is reported for the period ending May 31, 1982. Work was divided into 2 tasks: a literature search and a survey of state regulatory agencies and utilities in the region. The computer search concentrated on: waste disposal practices, groundwater quality monitoring, and fly ash/FGD waste chemistry. States in the study region are: Nevada, Arizona, Utah, New Mexico, Texas, Colorado, Wyoming, Montana, South Dakota, and North Dakota. (DMC)

56034 (DOE/FC/10184—1) **Chemical kinetic studies on dry sorbents. Final report.** Davis, W.T.; Keener, T.C. (Tennessee Univ., Knoxville (USA)). 15 Feb 1982. Contract AC18-80FC10184. 169p. NTIS, PC A08/MF A01. Order Number DE82012765.

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The scope of this research investigation has included a review of potential additives suitable for dry flue-gas desulfurization (FGD) and a bench scale laboratory study to determine the chemical kinetics for the reaction of five different sorbents with sulfur dioxide. The sorbents chosen included sodium bicarbonate ($NaHCO_3$), soda ash (Na_2CO_3), trona, lime (CaO) and hydrated lime ($Ca(OH)_2$). This study has shown that: (1) The reaction rate increases with temperature for soda ash and calcium oxide. The reaction temperature has an inverse effect on sodium bicarbonate and trona due, primarily, to the simultaneous thermal activation reaction. The calcium hydroxide-SO_2 reaction increased up to 550°F, and then decreased, due to uneven gas flow distribution. (2) The reaction rates for soda ash, calcium oxide and calcium hydroxide were increased by decreasing their particle size. This effect was not confirmed for sodium bicarbonate and trona where reaction temperature was the most important reaction parameter. (3) Reaction with soda ash was found to be limited by the presence of an impervious ash layer which prevented interparticle gaseous diffusion. Calcium oxide and calcium hydroxide were found to be limited by a slow chemical reaction rate. Results on the rate-limiting steps for sodium bicarbonate and trona were inconclusive because of the simultaneous thermal activation reaction. (4) The effect of thermal activation was to increase the reaction rate for sodium bicarbonate and trona at lower temperatures. This effect was less pronounced at higher temperatures. (5) Results obtained for nitric oxide show limited adsorption for the five sorbents tested as compared to the finding for sulfur dioxide.

56035 (DOE/MC/16229—T4) **Configurational testing of electron-beam ionization for coal-fly-ash precipitators. Quarterly report No. 4, September 2-December 1, 1981.** Davis, R.H. (Florida State Univ., Tallahassee (USA)). 1981. Contract AC21-81MC16229. 29p. NTIS, PC A03/MF A01. Order Number DE82017222.

During the fourth quarter of contract number DE-AC21-81MC16229 the wind tunnel of the Florida State University Electrostatic Precipitator Test System was delivered, assembled in place and fitting out began. Completion of the wind tunnel enclosure, the manufacture of internal parts of the modules, and the mounting of various subsystems had first priority during the quarter and will continue to do so until the system is put into operation. Concurrently a separate small test reactor for model gas studies important to the feasibility of combined treatment of SO_2, NO/sub x/ and particulate matter was designed. Dr. Keita Kawamura of the Ebara Company visited the laboratory and discussed the work his company has done on SO_2 and NO/sub x/ removal by electron beam treatment.

56036 (DOE/OR/03054—6, pp 9-16) **Comparison of chromate and nonchromate cooling water treatment methods.** Gough, J.R.; Lennon, D.R.; Yen, A.F. (International Coal Refining Co., Allentown, PA). 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

As part of the SRC-I Demonstration Plant design effort, ICRC conducted a study to evaluate available cooling water treatment, corrosion-prevention systems and to determine the most economical and efficient system that would meet federal and state environmental standards. To ensure appropriate application to the SRC-I plant, a literature search of chromate and nonchromate systems was made. Betz Laboratories, Calgon Corporation, and Air Products and Chemicals, Inc. (APCI) provided more specific information based on computer simulations or on field experience with cooling towers similar to that proposed for the SRC-I plant. This study determined that a high-phosphate/phosphate dispersant, nonchromate treatment system would approach the effectiveness of conventional chromate treatment programs. In addition, the stringent environmental standards imposed on chromate systems require the installation of expensive chromate removal facilities, which more than offset the higher chemical and metallurgical costs of nonchromate systems. It is therefore recommended that the nonchromate cooling water treatment program be selected for the SRC-I Demonstration Plant.

56037 (DOE/OR/03054—6, pp 31-45) **Wastewater characterization and treatability studies.** DiLeo, A.J. 1981. NTIS, PC A11/MF A01.

In SRC-I quarterly technical report, October-December 1981.

Successful operation of the 6000-ton-per-day (tpd) SRC-I Demonstration Plant will be contingent in part on safe treatment and disposal of the wastewater it generates. To ensure an effective and safe wastewater treatment design, APCI is conducting an ongoing program for ICRC to identify anticipated contaminants and to monitor the effectiveness of proposed treatment methods. SRC-I process recycle wastewater from the Ft. Lewis Pilot Plant is being used to simulate the plant's wastewater; after degassing, this is fed to biological reactor trains that biodegrade the contaminants. Significant quantities of nitrogen-containing organics have been observed in the process recycle wastewater. These compounds, estimated at levels of 1600 mg of N/L, are not removed by the chloroform extraction procedure currently used to characterize these wastewaters. Ammonia degassing has begun on the bioreactor feedstock. Current operating conditions lower the ammonia levels by an order of magnitude, to less than 500 ppM. We found that the tar acids could not be removed from the raw wastewater by simple pH adjustment; removal can be accomplished only after degassing. The amount of tar acids removed from the wastewater is 1.2 g/L (dry weight). This material was found to be predominately very polar, high-molecular-weight aromatics. Two biological oxidation reaction trains are now operating, one with and one without powdered activated carbon. The secondary (nitrification) bioreactor has been operating in series with the primary reactor, with an influent bypass (19% by volume) supplementing the flow from the primary reactor. Complete nitrification has been attained in the secondary reactor, with effluent nitrate levels at 66 to 71 ppM NO_3-N. The biological train with powdered carbon has been started up. Problems with sludge flotation are hindering performance of the primary reactor. Complete nitrification (66 to 71 ppM NO_3-N) has been attained in the secondary reactor.

56038 (EPRI-CS—2451) **Effects of process-water selection on lime-limestone flue-gas desulfurization chemistry. Final report.** Hargrove, O.W.; Seames, W.S.; Glover, R.L.; Blair, T.R. (Radian Corp., Austin, TX (USA)). Jul 1982. 130p. NTIS, PC A07/MF A01. Order Number DE82905833.

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The electric utility industry is interested in power plant water management both to conserve water and reduce waste water discharge to a minimum. For those power plants operating flue gas desulfurization systems, the water management becomes more complex, but utilization of waste water in the FGD system is possible. Calculations of the effects of the various waste water streams on operation of lime and limestone wet scrubbing processes have shown that in many cases the SO_2 removal is enhanced by using these streams as makeup water to the system. The results of calculations using various combinations of makeup water, reagents, and flue gas compositions are given in this report.

56039 (EPRI-CS—2467) **Construction and operation of a prototype RESOX plant in conjunction with Bergbau-Forschung FGD system. Final report.** Pickering, H.C. Jr.; Raskin, N. (Foster Wheeler Energy Corp., Livingston, NJ (USA); Deutsche Babcock A.G., Oberhausen (Germany, F.R.); Bergbau-Forschung G.m.b.H., Essen (Germany, F.R.); STEAG A.G., Essen (Germany, F.R.)). Jul 1982. 301p. NTIS, PC A14/MF A01. Order Number DE82905840.

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This report describes work done on an EPRI sponsored program intended to evaluate a dry FGD system. The program combined an existing Bergbau-Forschung activated coke SO_2 regenerative adsorption plant with the Foster Wheeler RESOX process. This process reduces concentrated SO_2 from the adsorption plant regenerator to elemental sulfur using coal as a reactant. The front end adsorption plant operates with a 43MW slip stream from the

Kellerman Power Station located in Luenen, Germany. The EPRI funded program designed, built and tested the RESOX system in conjunction with operation of the Bergbau-Forschung FGD plant. Throughout the report mechanical performance aspects of the program are emphasized. The RESOX system processed SO_2 rich gas for an accumulated total of 1000 hours. Experience gained during this operation is discussed.

56040 (PB—82-157413) Banklick Corporation coal-liquid project, Jacksonville, Florida; Caguas municipal solid waste gasification project, Caguas, Puerto Rico; Levy Reclaform Company coke-briquets project, River Rouge, Michigan: section 13(C) water assessment report. (Water Resources Council, Washington, DC (USA)). Sep 1981. 12p. NTIS, PC A02/MF A01.

The report describes an assessment of water supply requirements for three different projects. This report gives information on the Banklick Corporation plans to construct a coal preparation plant that will grind coal and mix it with oil and water to form substitutes for fuel oil in Jacksonville, Florida. The City of Caguas, Puerto Rico plans to install either a bottom-fed, air-blown, low BTU gasifier subsystem or a refuse-derived fuel preparation subsystem. The Levy Reclaform project will collect the fine particles generated in coke production that would otherwise be lost and will agglomerate these into briquets for blast furnace fuel. This project is located near Detroit, Michigan.

56041 (PB—82-160268) Fine coal-refuse slurry dewatering. Report of Investigations/1981. Backer, R.R.; Busch, R.A. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). Dec 1981. 24p. NTIS, PC A02/MF A01.

The Bureau of Mines, in cooperation with Washington Irrigation and Development Co. (WIDCO), evaluated the dewatering of fine coal-refuse slurry using chemicals and various types and combinations of drains in natural earth impoundments. About 40 lb of lime and 2 lb of polymer per ton of dry solids were mixed with the underflow from the preparation-plant thickener. Clear, free water was immediately liberated from the slurry. The percent solids by weight of the slurry increased from about 17 to 30 immediately, and after 5 days increased to 45 wt-pct. This indicates a threefold reduction in total volume after 5 days from 172 cu ft/ton solids originally to 56 cu ft/ton solids.

56042 (PB—82-183898) Disposal of excess spoil from coal mining and the Surface Mining Control and Reclamation Act of 1977: a study of regulatory requirements, engineering practices, and environmental protection objectives. Final report 14 May 80-13 Nov 81. (National Academy of Sciences - National Research Council, Washington, DC (USA)). Nov 1981. 221p. NTIS, PC A10/MF A01.

The Committee recommended that Office of Surface Mining's regulatory program be goal-oriented, using only certain minimum mandatory performance standards instead of the design standards approach now in use. Field-oriented technical assistance units should be established to work with coal producers on technical problems of excess spoil disposal and other problems related to environmental protection standards of the act. The Committee suggested establishment of regional guidelines so that regulatory standards could be applied taking account of the different geologic, climatic, and terrain conditions of the various coal regions.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 56033, 56105, 56452, 57117, 57746, 58123, 58162, 58175

56043 (DOE/EV/10256—2) Revegetation of Alaskan coal mine spoils. Progress report for research. Mitchell, W.W.; Mitchell, G.A.; McKendrick, J.D. (Alaska Univ., Palmer (USA). Agricultural Experiment Station). 28 Oct 1981. Contract AT06-79EV10256. 60p. NTIS, PC A04/MF A01. Order Number DE82020041.

Research on revegetation of Alaskan coal mine spoils and related topics was conducted at three mine locations in 1980 and 1981. One of the locations was at an active commercial mine, another at an abandoned mine, and the third at a test pit in a coal field that appears on the verge of development. The research included a number of plantings to test the adaptability of plant materials at various sites, time-of-planting and planting method trials, tests to determine fertilizer needs and plant responses to specific elements, numerous soil samplings to characterize minesoil materials and relate soil conditions to apparent performance of reclamation plantings that have been conducted at one mine over a period of nine years, base studies assessing faunal populations and their representation on replanted mine spoils, and studies of nutrient quality of native vegetation and reclamation plantings. This report will be presented in three sections. The first section will deal with the fertility and minesoil characterization studies, the second with the plant material studies, and the third with the faunal and plant quality studies.

56044 (ORNL/TM—8035) Baseline environmental characterization of Pike County Coal-Gasification Facility site. Environmental Sciences Division publication No. 1858. Cushman, R.M.; Suter, G.W. II; Bailey, M.E.; Hosker, R.P.; Jordan, C.; Nappo, C.J.; Satterfield, L.C.; Snodgrass, H.F. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 50p. NTIS, PC A03/MF A01. Order Number DE82020462.

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Preoperational monitoring at the proposed site of the Pike County (Kentucky) Coal Gasification Facility consisted of two tasks: analysis of surface water quality and characterization of site meteorology. Analysis of surface water in Shelby Creek and a small tributary confirmed earlier reports of marginal water quality in the area. Values of alkalinity, ammonia, copper, zinc, and iron were outside recommended ranges. Meteorological studies showed that the complex terrain of the site could have a major effect on pollutant dispersion. The surface air, which is decoupled from regional air flow, usually extends to ridge height, approximately 300 m above the site. At night, the air is typically calm with frequent fog and ground-based or elevated inversions. During the day, frequent convective air flow interacts with the terrain, producing mechanical turbulence. Mechanical turbulence was verified by the helical pattern and irregular direction of experimental smoke releases. The potential for ground-level air pollution appears to be high. Plume impactions with the surrounding terrain could occur during daytime, causing damage to vegetation. Also, plume material that contacts the terrain may lose its bouyancy and sink to lower elevations or be carried down by drainage currents. Although the anticipated effective plume height (approximately 100 m) of the proposed facility is well below ridge height, the high frequency of weak winds may often allow the plume to extend above the ridge top. The combination of elevated inversions and fog (which cools the plume) suggests that at night the plume may often be contained within the site. Chemical interaction of plume materials with nighttime moisture could be an additional problem. These tentative results suggest that any pollutants released at this site should be carefully monitored.

56045 (PB—82-157876) Delineation of acid mine drainage potential of coal-bearing strata of the Pottsville and Allegheny Groups in western Pennsylvania. Technical completion report. Hornberger, R.J.; Parizek, R.R.; Williams, E.G. (Pennsylvania State Univ., University Park (USA). Dept. of Geosciences). Nov 1981. 380p. NTIS, PC A17/MF A01.

The goal of the research was to test the relationship between paleoenvironment and acid mine drainage production on a regional basis. Coal mining data from 23 counties, or approximately 225 quadrangles, were obtained from mine drainage permit records, and a computer program was written to map these data. More than 150,000 lines of water-quality data were retrieved from the STORET data base, from which contour maps and trend surface maps were constructed. A computer program was developed to compare the water-quality and coal mining data using a grid cell structure.

56046 (PB—82-160433) Site selection study for the Keystone Project. Final report. (Energy Impact Associates, Inc., Pittsburgh, PA (USA)). Apr 1981. 106p. NTIS, PC A06/MF A01.

The purpose of this study was to determine which of four potential sites in the Johnstown area could accommodate a 100,000 BPD coal-to-methanol facility (Keystone Project). Considered in the 'reconnaissance' level effort were environmental, social, engineering and cost parameters based on preliminary design data from the Keystone Project. The conclusion of the study was that all the four sites are acceptable and no major obstacles presently exist. The four sites were also rated based on engineering and economic factors. It is also concluded that additional engineering analysis is required to define the costs of site preparation and transmission access.

56047 (PB—82-161928) Low BTU coal gasification demonstration project, Georgetown, KY. Water assessment report. (Water Resources Council, Washington, DC (USA)). 10 Jul 1978. 8p. NTIS, PC A02/MF A01.

The report is the result of a water assessment of water requirements and water supply availability for a proposed low BTU coal gasification demonstration project of the Department of Energy at Georgetown, KY.

56048 (PB—82-163965) Engineering property changes and environmental effects on coal mine wastes due to slaking. Open-file report 26 Sep 1978-15 May 1981. (Wahler (W.A.) and Associates, Palo Alto, CA (USA)). May 1981. 283p. NTIS, PC A13/MF A01.

Fresh coal refuse was sampled at 21 U.S. mines; 5 were drilled, sampled, and tested more extensively than the remaining 16. Field tests included standard penetration tests and in situ density determinations. Laboratory testing included specific gravity, gradation, maximum and minimum density tests, 9-inch drained triaxial tests, 9 and 10-inch permeability tests, slake-durability tests, and accelerated slaking tests. Some refuse sites had significantly lower shear strengths and permeabilities in old, slaked, or weathered material than in fresh refuse. The state-of-art in slaking research, and the implications of slaking on coal refuse disposal, and on practical methods of managing slaking, were also studied.

56049 (PB—82-164039) Synthetic fuel development for the Upper Missouri River Basin (13(A) water assessment report). Final report. (Missouri River Basin Commission, Omaha, NE (USA)). Apr 1981. 129p. NTIS, PC A07/MF A01.

This report is the result of an assessment of water requirements, water supply availability and other water implications of synthetic fuel developed in the Upper Missouri River Basin.

56050 (PB—82-171455) Environmental factors influencing the use of coal as a marine boiler fuel. Final report 8 May 1981-15 February 1982. Woodcock, B.; Sullivan, D. (Versar, Inc., Springfield, VA (USA)). Feb 1982. 294p. NTIS, PC A13/MF A01.

The environmental effects that may occur under a specified coal-fired ship scenario were estimated. Both air emissions and water emissions were included. The ship scenario was broken down by port, region, ship size, and trade. Six coals were chosen for the analysis. Marine boiler characteristics were investigated and used to aid in determining emission rates. Air and water quality modeling was performed to estimate impacts. Based on the scenario set forth at the beginning of the project, potential may exist for adversely impacting both air and water quality in the port area.

56051 (PB—82-181090) Impact of alternate energy sources in the greater Egypt region. Final report. (Greater Egypt Regional Planning and Development Commission, Carbondale, IL (USA)). Jun 1981. 142p. (GERPDC—81-603). NTIS, PC A07/MF A01.

The report examines economic and environmental aspects of alternate energy sources for the five-county Greater Egypt Economic Development District in Southern Illinois. The report can serve as a primer in the energy field for local government officials in the various energy sources available. Included are coal, oil, gas, coal conversion, and solar.

56052 (PB—82-182056) Coal mining and ground-water resources in the United States. Final report. (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1981. 214p. NTIS, PC A10/MF A01.

The report notes the widespread concern in this country over possible consequences for our water resources of the relatively recent emphasis on development of fossil fuels and the reclamation and use of land that will follow it. The response to the public concern as reflected in legislation and policy has focused on two issues. One is that water resources are not everywhere or always present in sufficient quantity or quality to satisfy the needs of the energy industry. The other is that, as a result of energy industry and land reclamation activity, the quality of the water that is available may be significantly degraded. The report presents coal mining as one of many uses competing for the nation's ground-water resources and addresses principles that govern the functioning of hydrogeologic systems and the various institutions that oversee ground-water allocation.

56053 (TVA/ONR/ARP—82/13) Ambient air quality monitoring plan, Johnsonville Steam Plant. Lee, N.T.; Carter, R.V.; Eckhoff, P.A. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Natural Resources). Apr 1982. 30p. NTIS, PC A03/MF A01. Order Number DE82903942.

TVA has operated an ambient air quality monitoring network at Johnsonville Steam Plant since 1950. The monitoring was initially conducted to collect background information prior to plant startup (1951) and ultimately to document the impact of plant emissions on ambient air quality after it reached full operating capacity in 1959. In 1976, TVA implemented a plan to bring the steam plant into compliance with provisions of the Clean Air Act by demonstrating that it met applicable ambient air quality standards for sulfur dioxide (SO_2). This option was allowed at that time under the Tennessee State Implementation Plan (SIP) and was selected by TVA as being the most practical means of achieving compliance. This air quality monitoring plan is described in this report. TVA's strategy for meeting ambient standards was its Sulfur Dioxide Emission Limitation (SDEL) program. This program provided for the control of plant emissions through the intermittent reduction of power generation under meteorological conditions conducive to ambient SO_2 concentrations in excess of National Ambient Air Quality Standards (NAAQS). Seven SO_2 monitors were added to the existing network to provide monitoring support for the SDEL program. Data from the monitoring network were used to verify that SO_2 standards were not exceeded and to upgrade SDEL program effectiveness. The SDEL program has operated continuously at Johnsonville since its implementation in 1976. It was integrated into the Consent Decree interim control plan in 1978 to control SO_2 emissions until July 1982 when the plant will meet the required 3.4 lb/10^6 Btu emission standard. Compliance with this standard will be met by burning low- to medium-sulfur coel.

56054 (UCRL—88012) Mechanisms for groundwater contamination by UCG: preliminary conclusions from the Hoe Creek study. Wang, F.T.; Mead, S.W.; Stuermer, D.H. (Lawrence Livermore National Lab., CA (USA)). 3 Aug 1982. Contract W-7405-ENG-48. 13p. (CONF-820840—7). NTIS, PC A02/MF A01. Order Number DE82020348.

From 8. underground coal conversion symposium; Keystone, CO, USA (15 Aug 1982).

We have monitored groundwater quality changes in approximately 60 wells constructed near the 3 underground coal gasification (UCG) experiments carried out at our Hoe Creek site in northeastern Wyoming. A broad range of residual gasification products are introduced into the groundwater system as a result of the UCG process. These groundwater contaminants may be of environmental significance if they find their way, in sufficient concentrations, into surface waters or aquifers from which water is extracted for drinking or agricultural purposes. In seeking to identify effective control technologies or mitigation measures, we have found it important to investigate the mechanisms responsible for the formation and dispersal of the contaminants. For example, an important mechanism for the production of organic contaminants may be pyrolysis reactions along the surfaces of cracks through which hot product gases escape from the cavity during gasification. As gasification continues, these pyrolysis products will be distilled further out in the surrounding coal and deposited on the coal surfaces. Other mechanisms that are believed to be important are post-burn pyrolysis as a result of residual cavity heat and the liberation of minerals from the coal by the action of dissolved CO_2.

56055 **Carbon dioxide: emissions and effects.** Smith, I.M. London, England; IEA Coal Research (1982). 132p. (ICTIS/TR—18). IEA Coal Research, 14/15 Lower Grosvenor Place, London, SW1W OEX, England.

This review provides a comprehensive guide to work carried out since 1978 in the many disciplines involved in this complex issue. Possible scenarios for carbon dioxide emissions, sources and sinks in the carbon cycle and for climatic changes are examined. The current concensus (by no means unanimous) of specialists on this issue appears to be that a continuation of reduced trends in energy consumption since 1973 is likely to double the atmospheric carbon dioxide concentration to 600 ppmv during the latter part of the next century. However, a higher demand scenario, requiring an upper limit of coal production, would bring forward the doubling to about the middle of the next century. Current climatic models predict that such a concentration of carbon dioxide would cause an average global warming of from 1.0 to 4.5°C which might be delayed by the thermal inertia of the oceans. A warming due to estimated increases in carbon dioxide should, if the model results are correct, become apparent at the end of this century. Regional climatic changes are likely to vary considerably and prove disadvantageous to some regions and beneficial to others. Different strategies for dealing with the carbon dioxide issue are considered: no response, alleviation, countermeasures and prevention. It is concluded that uncertainties do not justify either the use of carbon dioxide disposal and other technical fixes at present or a policy of no further growth in fossil fuel consumption. On the other hand, major efforts to conserve energy would give more time to adapt to changes. The alleviation of climatic impacts and other desirable dual-benefit measures are advocated in addition to continuing international, interdisciplinary research on all aspects.

56056 **Health and safety implications of alternative energy technologies - 3. Fossil energy.** Walsh, P.J.; Etnier, E.L.; Watson, A.P. (Oak Ridge Natl Lab, Tenn, USA). *Environmental Management;* 5: No. 6, 483-494(Nov 1981).

This paper reviews both innovative fossil energy sources (tar sands, oil shale, and unconventional natural gas), and more established technologies that are being considered as suppliers of gaseous and liquid fuels (that is, coal gasification and liquefaction). Potential health and safety issues related to the technologies are discussed, although the absence of commerical-scale facilities in the United States restricts the discussion to health effects information derived from related processes. The available epidemiological and carcinogenic studies give causes for concern. The study of the health and environmental impacts of the emerging fossil fuel technologies will be important for quantification of adverse effects and rectification of problems before commitment to large-scale commercialization occurs.Refs.

56057 **Nitrogen-containing polycyclic aromatic compounds in sooting flames.** Kausch, W.J. Jr.; Clampitt, C.M.; Prado, G.; Hites, R.A.; Howard, J.B. (MIT, Cambridge, MA). *Symposium (International) on Combustion,* [*Proceedings*]; 1097-1104(1981). (CONF-800809—).

From 18. combustion symposium; Waterloo, Canada (17 Aug 1980).

The production of nitrogen-containing polycyclic aromatic compounds in benzene/methane flames doped with organic nitrogen and in coal combustion was studied in small-scale equipment. The compounds were analyzed by gas chromatography with and without a nitrogen specific flame ionization detector. Selected runs with benzene/methane flames were also conducted with sulfur-containing fuel additives, namely carbon disulfide or thiophene. None of the fuel additives exerted any discernible effect on the quantities of polycyclic aromatic hydrocarbons or soot formed in the benzene/methane flames. Cyanonaphthalenes, cyanoacenaphthylenes, and cyanophenanthrenes were found in significant quantities in association with soot formed in the nitrogen-doped benzene/methane flames, and in the coal combustor. The nitrogen source in these compounds was determined to be fuel rather than atmospheric nitrogen. 31 refs.

56058 **Comparison of bacterial luminescence and fish bioassay results for fossil-fuel process waters and phenolic constituents.** Lebsack, M.E.; Anderson, A.D.; DeGraeve, G.M.; Bergman, H.L. (Veterans Adm Hosp, Bronx, NY). *American Society for Testing and Materials, Special Technical Publication;* No. 737, v(1981). (CONF-7910273—).

From 4. annual symposium on aquatic toxicology; Chicago, IL, USA (16 Oct 1979).

Luminescence was decreased in a concentration-dependent manner after the addition of an oil shale process water. The concentration causing 50 percent inhibition of luminescence (EC/sub 50/) was reproducibly determined for all the tested waters and compounds. The EC/sub 50/ values for a group of fossil-fuel process waters correlated with 96-h rainbow trout flow-through median lethal concentrations (LC/sub 50/s) but not with 96-h flow-through LC/sub 50/s for fathead minnows. For another group of process waters, the EC/sub 50/s for luminescence inhibition had a significant correlation to static 24-h LC/sub 50/s with fathead minnows. Both rainbow trout and fathead minnow LC/sub 50/s were lower than luminescence EC/sub 50/s for the phenolic compounds. Inhibition of bacterial luminescence may be of value in predicting the toxicity of complex effluents to aquatic biota, especially when semicontinuous monitoring is required. However, in each case the bacterial bioluminescence assay should be calibrated periodically with acute bioassays using aquatic biota. 13 refs.

56059 **Identification of components in aqueous effluents associated with new coal technologies and geothermal energy sources.** Gebhart, J.E.; Segesta, R.M.; Rando, L.C. (Gulf South Res Inst, New Orleans, LA). *American Society for Testing and Materials, Special Technical Publication;* No. 720, 86-94(1980). (CONF-790663—).

From Symposium on analysis of waters associated with alternate fuel production; Pittsburgh, PA, USA (4 Jun 1979).

Aqueous effluents from a coal gasification operation and from a geothermal energy process were analyzed using established procedures. The results of the analysis for metals by spark source mass spectrometry are given. This report stresses the identification of organic compounds in the sample by combined gas chromatography-mass spectrometry and computerized spectral matching techniques. 4 refs.

56060 **Comparison of analytical methods for phenols, cyanide, and sulfate as applied to groundwater samples from underground coal gasification sites.** Wang, F.T. (Lawrence Livermore Lab, CA). *American Society for Testing and Materials, Special Technical Publication;* No. 720, 179-184(1980). (CONF-790663—).

From Symposium on analysis of waters associated with alternate fuel production; Pittsburgh, PA, USA (4 Jun 1979).

Groundwater samples, obtained near two underground coal gasification experiment sites, have been analyzed for phenols, cyanide, and sulfate. The samples were analyzed in the field; they were also preserved and sent to remote laboratories for analysis. Comparisons of the results have shown that the agreement between laboratory and field analyses is fairly good. This indicates that the methods of preservation are effective for these types of groundwater samples and that field analysis gives reliable information. 9 refs.

0110 Reserves And Exploration

56061 **(DOE/ET/14692—T3) Inventory of peat resources, Aitkin County, Minnesota.** (Minnesota Dept. of Natural Resources, St. Paul (USA). Div. of Minerals). 1982. Contract FG01-79ET14692. 108p. NTIS, PC A06/MF A01. Order Number DE82019863.

Portions of document are illegible.

The subject of this report is the Minnesota Peat Inventory Project (MPIP) reconnaissance-level peatland survey of Aitkin County, which contains 170,050 ha (420,160 ac) of peatland. The main objectives of this study were to map the resource and to determine the quality, quantity, and energy potential of peat in the county. The report consists of (1) a text that discusses the resource and the survey; and (2) a map of the peat resources in Aitkin County. Over 700 sites were visited by the MPIP to determine peat type and depth. Samples were obtained from 188 selected representative sites for MPIP laboratory analysis. Peatlands cover 170,050 ha (420,160 ac) or 33% of the total area of Aitkin County. Total oven-dried tons of peat amount to 246,414,000 metric tons (276,237,000 US short tons). The peatlands meeting the DOE criteria for fuel-grade peat cover 30,390 ha (75,080 ac) or 18% of the county's lands is 98,134,000 oven-dried metric tons (110,012,000 oven-dried US short tons). These peatlands cover at least 80 contiguous acres and are composed of peat that (1) has an average energy value of 8,874 Btu/lb (moisture-free), (2) has an average ash content of 10.6%, and (3) is at least 150 cm (5 ft) deep. The estimated potential energy of these peat deposits is 1.97 x 10^{15} Btu (1.97 quads of energy) if all three peat types, fibric, hemic, and sapric, in deposits greater than 150 cm deep are considered.

56062 (DOE/ET/14692—T3-App.D) Inventory of peat resources, Aitkin County, Minnesota. Appendix D, observation site descriptions. (Minnesota Dept. of Natural Resources, St. Paul (USA)). 1982. Contract FG01-79ET14692. 57p. NTIS, PC A04/MF A01. Order Number DE82020732.

Portions of document are illegible.

This appendix contains supplementary data on the peat resources of Aitkin County, Minnesota. Included are site locations; peat profile descriptions, including underlying soil texture; vegetation descriptions; microrelief; and depth to water table.

0120 Mining

REFER ALSO TO CITATION(S) 56042, 56048, 56052, 56084, 56112, 56114, 56115, 57113

56063 (DOE/ET/10022—1) Development and fabrication of a dragline training system. Final technical report, February 1982. Eschman, C.W.; Eschenbrenner, A.J. (McDonnell Douglas Electronics Co., St. Charles, MO (USA)). Mar 1982. Contract AC22-79ET10022. 143p. NTIS, PC A07/MF A01. Order Number DE82012447.

Portions of document are illegible.

The Dragline Training System developed under US DOE Contract No. DE-AC22-79ET10022 provides classroom materials, training aids and a dragline simulator to provide an extensive two week instruction and skills development program for training and retraining of dragline operators. This program included refinement of training concepts, development and printing of text and media materials, development and fabrication of training aids, part task trainers and the dragline simulator, and validation of the training system. This report describes the training system and its validation and provides recommendations for a second generation training system.

56064 (DOE/ET/12489—T1) Evaluation of the Kloswall longwall mining system. Final report. (Foster-Miller Associates, Inc., Waltham, MA (USA)). Apr 1982. Contract AC01-76ET12489. 131p. NTIS, PC A07/MF A01. Order Number DE82015881.

Portions of document are illegible.

This report presents the results of design studies and critical requiremental tests of a new longwall mining system specifically designed to extract a very deep web (48 inches or deeper) from a longwall panel. The report includes a productivity and cost analysis comparing the new mining system with a conventional longwall operation taking a 30-inch wide web. The analysis shows the new system will increase annual production and return on investment in most cases. The report also includes conceptual drawings and specifications for a high capacity three-drum shearer and a unique shield type of roof support specifically designed for very wide web operation. The advantages and problems associated with wide web mining are discussed in general and as they relate specifically to the equipment selected for the new mining system. Details of the critical testing and the test results are presented. The study concludes by recommending that surface tests of the haulage and guidance system be conducted as the follow-on work.

56065 (DOE/ET/13346—T61) Monorail bridge conveyor. Phase II report. Gonski, J. (Goodman Equipment Corp., Chicago, IL (USA)). 30 Apr 1982. Contract AC01-78ET13346. 106p. NTIS, PC A06/MF A01. Order Number DE82015156.

Portions of document are illegible.

This report covers the second phase of a four-phase contract to develop and test a roof hung monorail bridge conveyor coal haulage system working behind a continuous miner. Phase II covers the fabrication and assembly of all the components in making up the Monoral Bridge Conveyor System. The original concept presented had to be analyzed before final design could proceed. The analysis revealed that 24 ft. long bridge conveyor segments were the optimum length; the suspension system must have the vertical hinge point between bridges, the impact point of the coal transfer point and the suspension point itself, coincidental. The propulsion system is such that each bridge is self propelled in order to minimize side loading on the monorail. The conveyor belt drive is simple since it only has to drive one single 24 ft. conveyor. The entire assembly of twelve conveyors has been pre-tested in our Murfreesboro, Tennessee, shop. The electric circuit proved successful to operate from a manual control or automatically, and successfully proved the cycle of sequential strating and stopping.

56066 (DOE/FE/00094—T1) Determining the research needs of the surface-coal-mining industry. Final report. Zell, L.M. (Mining and Reclamation Council of America, Washington, DC). Jul 1982. Contract FG01-81FE00094. 146p. NTIS, PC A07/MF A01. Order Number DE82019991.

Portions of document are illegible.

Future increases in coal production and utilization will be largely dependent upon the development of new technologies that allow coal to be mined and utilized in an environmentally sound manner. Complexities and impacts of the new surface-mining regulations have created additional concern for both the development of new mining and reclamation procedures and for the implementation of such research efforts in the field. The Department of Energy's Office of Coal Mining and the Mining and Reclamation Council of America (MARC) are committed to the identification and resolution of technical problems facing the surface-coal-mining industry. Recognizing the difficulty of assimilating, summarizing and disseminating technological advances to the coal industry, MARC conducted a nationwide study to bring together the diverse elements of the industry to develop a comprehensive list of practical and theoretical research needs which would help to mitigate these deficiencies. The results of this survey should provide a documented frame of reference for federal and private-sector decision makers assessing priority research needs.

56067 (PB—82-137837) Microseismic roof fall warning system development: field trials and commercial prototype fabrication. Volume I. Open file report (final) Aug 77-Dec 79. Fisher, C. Jr; Thompson, R.H. (Integrated Sciences, Inc., Longmont, CO (USA)). 30 May 1980. 197p. NTIS, PC A09/MF A01.

A microseismic roof fall warning system was field tested in Western and Eastern coal mines in the United States to better define the capabilities and limitations of the microseismic method in predicting roof fall. Microseismic event and energy type data were obtained and documented for 23 coal roof falls. Field test results indicate that both the microseismic event and energy methods, as applied, have a high probability for successful application in a commercially practical roof fall warning system. Volume I contains details of the investigation.

56068 (PB—82-137845) Microseismic roof fall warning system development: field trials and commercial prototype fabrication. Volume II. Appendix C: coal mine data collection summary. Open file report (final) Aug 77-Dec 79. Fisher Jr, C. (Integrated Sciences, Inc., Longmont, CO (USA)). 30 May 1980. 227p. NTIS, PC A11/MF A01.

A microseismic roof fall warning system was field tested in Western and Eastern coal mines in the United States to better define the capabilities and limitations of the microseismic method in predicting roof fall. Microseismic event and energy type data were obtained and documented for 23 coal mine roof falls. Field test results indicate that both the microseismic event and energy methods, as applied, have a high probability for successful application in a commercially practical roof fall warning system. Volume II summarizes the data collected.

56069 (PB—82-138298) Interactive mine-power-system analysis: Volume I. Open file report, 28 September 1979-30 November 1980. Trutt, F.C.; Morley, L.A.; Rivell, R.A. (Pennsylvania State Univ., University Park (USA)). 31 Jan 1981. 209p. NTIS, PC A10/MF A01.

This report is intended as a reference for personnel interested in the computer analysis of coal mine electrical power systems under either normal operating conditions or fault situations. The procedures developed are described and implementation considerations are discussed. Considerations for choosing a solution technique and some examples are included. During program development, strict attention was given to the inclusion of core and/or time-saving techniques such that these algorithms may be implemented on small or large computers. Program languages include Fortran IV for batch processing applications and APL or BASIC for interactive applications.

56070 (PB—82-138306) Interactive mine-power-system analysis. User's manual: Volume II. Open file report, 28 September 1979-28 January 1980. Rivell, R.A.; Trutt, F.C.; Morley, L.A. (Pennsylvania State Univ., University Park (USA)). 28 Jan 1980. 230p. NTIS, PC A11/MF A01.

This user's manual is intended as a reference for personnel interested in the analysis of coal mine electrical power systems. The interactive procedures are discussed. Considerations for choosing a solution technique and some examples are included. Procedures available include Gauss-Seidel and Newton-Raphson iterative techniques for analysis of normal operation or balanced faults and a noniterative Z-bus technique for analysis of unbalanced or balanced faults.

56071 (PB—82-148388) Monitoring of mine air diesel pollutants: tailpipe emissions measurement apparatus, detector tube interferences, and exhaust and ventilation system control. Annual report 1 Aug 79-31 Jul 80. Johnson, J.H.; Carlson, D.H.; Reinbold, E.O.; Osborne, M.D. (Michigan Technological Univ., Houghton (USA)). 31 Jul 1980. 267p. NTIS, PC A12/MF A01.

The objective of this work was to develop and test engineering approaches to the control of air quality for the protection of miners health in dieselized underground mines. A general experimental approach was developed by which instruments could be compared for the measurement of diesel exhaust pollutant concentrations in the 0.5 to 5 TLV range. Drager detector tube diluted exhaust CO, CO2, NO, and NO2 measurements were compared with simultaneously taken portable instrument measurements. The effects of two exhaust system configurations on the pollutant concentrations in a dead-end heading were studied in the report.

56072 (PB—82-151333) The development of high expansion foam systems for the suppression of respirable coal dust. Final report. Friel, J.V.; Hays, H.E.; Hiltz, R.H. (MSA Research Corp., Evans City, PA (USA)). 15 Aug 1973. 55p. (MSAR—73-82). NTIS, PC A04/MF A01.

The current practice of mining coal underground with continuous mining machines provides levels of coal dust in the immediate area beyond the limits deemed safe for continuing exposure of the operating personnel. Effective control of the respirable portion of the dust has not been possible with the current methods of allaying the dust. The present practice depends on water sprays to minimize the amount of dust generated and face ventilation to remove that which does become airborne. Solutions, therefore, are required which can be applied to the current operations. A number of solutions have been proposed to accomplish this result on existing machinery. Among these, and one with considerable merit, is the use of high expansion foam to blanket the cutting operation, preventing the release of dust into the air. This is not a new system. In almost every instance where foam application was such that the dust was not allowed to become airborne, significant reductions in dust concentrations were noted. In each case, however, there were drawbacks to prevent the use of foam for dust suppression, not the least of which were the economics involved. The failure of detergent foams to achieve practical results in these tests should in no way reflect on its ultimate ability as a method of dust control.

56073 (PB—82-166471) Area terrace pit coal mining systems: volume 1--technical and economic evaluation of terrace pit mining systems. Open file report (final) Sep 1977-Jul 1980. Leonard, F.; Simon, C.; Stoddard, M.; Verma, M.; White, M. (Dames and Moore, Golden, CO (USA)). Oct 1980. 296p. NTIS, PC A13/MF A01.

This report is principally concerned with the engineering and economic feasibility of area surface coal mining systems other than draglines. This analysis evaluates shovel-trucks, shovel-crusher-conveyors, and shovel-rail excavation and haulage systems for an assortment of geologic environments and production rates in the Powder River Basin (PRB). Shovel-trucks, front-end loader-trucks, and shovel-crusher conveyors were studied in a multiseam, dipping geologic area of the Four Corners region. The Texas lignite engineering and economic research involved bucket-wheel excavators (BWE), BWE-backhoes, and scraper-backhoe combinations for overburden and coal excavation. The PRB truck-shovel study utilized the most recent computer simulation available in both the design and cost analysis. Detailed engineering analysis, followed by in-depth operating costs result in a complete evaluation of each mining system. Cost comparisons of the different mining systems under similar geologic and production constraints are presented to illustrate the estimated capital investment and production costs per ton of coal and bank cubic yard of overburden.

56074 (PB—82-166489) Area terrace pit coal mining systems: volume 2--appendices. Open file report (final) Sep 1977-Jul 1980. Leonard, F.; Simon, C.; Stoddard, M.; Verma, M.; White, M. (Dames and Moore, Golden, CO (USA)). Oct 1980. 449p. NTIS, PC A19/MF A01.

This report is principally concerned with the engineering and economic feasibility of area surface coal mining systems other than draglines. This analysis evaluates shovel-trucks, shovel-crusher-conveyors, and shovel-rail excavation and haulage systems for an assortment of geologic environments and production rates in the Powder River Basin (PRB). Shovel-trucks, front-end loader-trucks, and shovel-crusher-conveyors were studied in a multiseam, dipping geologic area of the Four Corners region. The Texas lignite engineering and economic research involved bucket-wheel excavators (BWE), BWE-backhoes, and scraper-backhoe combinations for overburden and coal excavation.

56075 (PB—82-170036) Faults and their effect on coal mining in Illinois. Nelson, W.J. (Illinois State Geological Survey, Urbana (USA)). 1981. 46p. NTIS, PC A03/MF A01.

Faults are one of many types of geologic disturbances that affect coal seams. They are common in coal seams of Illinois and have considerable effects on coal mining, such as: offsetting of the coal seams, creation of grades too steep for mining equipment to follow, weakening of roof and ribs, admission of water and gas into workings, and introduction of clay and other impurities into the coal. Faults can be grouped into tectonic faults and nontectonic faults. The presence of most tectonic faults can be predicted before mining begins and their location determined by drilling, seismic exploration, and other means. The major systems of tectonic faults in Illinois that influence coal mining are located in the southern part of the state. They include the Cottage Grove, Wabash Valley, and Rend Lake Fault Systems, the Dowell Fault Zone and Centralia Fault, the Shawneetown Fault Zone, and faults in the Eagle Valley Syncline. Nontectonic faults are found in every mine in the state, although they are more troublesome in some areas than in others. Many nontectonic faults are strongly controlled by lithologic patterns in the rocks above a coal seam. The relationship of nontectonic faults to lithology often can be mapped so that the presence of the faults can be predicted a short distance ahead of the face. Mining plans should be as flexible as possible to allow adaptation to local conditions in faulted areas.

56076 **(PB—82-172719) Field survey of float dust in coal mining operations. Research report Mar 80-Mar 81.** Kost, J.A.; Colinet, J.F.; Shirey, G.A. (Bituminous Coal Research, Inc., Monroeville, PA (USA)). Oct 1981. 163p. NTIS, PC A08/MF A01.

The objectives of this investigation were to determine the amount, size, and deposition of float coal dust generated during the mining and transporting of coal in underground U.S. mining operations. Rock dust distributed by trickle dusters was also sampled. In addition to four belt-transfer points, two continuous and two conventional mining sections were sampled at five mines located in Pennsylvania, West Virginia, Kentucky, and Illinois. Float-dust samples were collected on deposition pans; total airborne dust was collected with MSA model G Personal samplers equipped with Unico filter casettes; Andersen cascade impactors provided relative size distributions of the samples. Production, airflow, and waterflow were monitored to examine their effect on dust levels.

56077 **Development of guidance and control systems for longwall shearers.** Pazuchanics, M.J. (US DOE, Pittsburgh, Pa, USA). pp 13.1-13.16 of Proceedings of the WVU conference on coal mine electrotechnology (West Virginia University), 5th, 1980. Smith, N.S. (ed.). Morgantown, WV; West Virginia University (1980).

From 5. coal mine electrotechnology conference; Morgantown, WV, USA (30 Jul 1980).

The Department of Energy is engaged is a program of research and development to make improvements in coal extraction technology. One area deals with automating some of the extraction processes as a means fo increasing productivity, lowering costs, and creating a safer work environment. This study reports on the Department of Energy's efforts to automate the longwall mining extraction process. The discussion highlights progress made during the last two years on guidance and control subsystems and components. 16 refs.

56078 **EPRI's projection of electrical energy: demand and supply.** Esselman, W.H. pp 9-22 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The percentage of energy devoted to electricity production has increased from about 25% in 1970 to over 30% today. The continuation of this trend depends largely upon the economic value of electricity relative to other types of energy and the substitutibility between electric and nonelectric energies. The resulting electricity projection is shown. To supply this amount of electricity in view of the vast uncertainties in future electrical energy demand, requires the actions and energy sources, including: conservation to make a significant reduction in electricity usage; a substantial amount of supply from renewable resources, such as hydroelectric, geothermal and solar; coal-fired generation that expands at a rate which would require about two billion tons/year of total coal production in the year 2000, approximately three times the annual production rate in 1978; a rapidly expanding synfuel program to start replacing oil and gas for electricity generation in 1990; and a continuing nuclear power industry. Current assessments of the uncertainties of future supply show that such supply capabilities will be difficult to achieve. The job of expanding the use of coal to the required levels of about 2 billion tons/year will be extremely difficult, at best. To supply the electricity, a total of 467 GW of direct coal-fired power plant capacity would be needed in 2000. These units are estimated to generate approximately 2.5 trillion kWh that year. About 1.3 billion tons of coal will be required for this purpose. Nonelectric demand for coal in 2000 is estimated to be about 0.7 billion tons, making a total of 2.0 billion tons.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 56026, 56040, 56041, 56717

56079 **(AD-A—110061/9) Rail-to-barge coal transfer facility St. Louis, Missouri. Final environmental impact statement.** (Army Engineer District, St. Louis, MO (USA)). Jul 1976. 181p. NTIS PCMF A01.

ACBL Western, Inc. proposes to construct and operate a terminal facility with capabilities for transferring low-sulfur western coal from unit trains to river barges. The terminal will be located on the west bank of the Mississippi River in St. Louis, Missouri just north of the southern outlet of the Chain of Rocks Canal. The facility will occupy approximately 45 acres of presently unused industrially-zoned land between the Burlington-Northern Railroad Freight yard and Hall Street. The terminal will include a rotary car dumper, coal storage piles (500,000 tons) and an ancillary stacker/reclaimer, plus conveyors to carry the coal across the railroad yards and the floodwall to a barge loading facility located on the bank of the river.

56080 **(AD-A—111202/8) Great Lakes/St. Lawrence Seaway regional transportation study; Great Lakes area industries. Final report.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Nov 1981. 83p. NTIS, PC A05/MF A01.

This report is a general description of the major industries which are responsible for shipments for major commodities via the Great Lakes. These industry studies define the general framework for projection of bulk cargo forecasts.

56081 **(DOE/PC/42295—T3) Gravimelt Process Development. Quarterly technical progress report.** (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). 20 May 1982. Contract AC22-81PC42295. 59p. NTIS, PC A04/MF A01. Order Number DE82016019.

Portions of document are illegible.

During the current reporting period, the bench-scale Gravimelt system was completely installed and checked out for operation. Initial coal flow checkout was performed with aqueous zinc chloride as the leaching medium simulant and Illinois No. 6 coal as the feed. It was found that the coal moved through the system and drained at the outlet arm as designed. However, the aqueous zinc chloride tended to swell the coal causing plugging after about an hour's operation. It was found that the fused caustic did not swell the coal appreciably and the coal moves through the system essentially as designed with apparent excellent drainage occurring at the outlet arm. Downstream batch washing and centrifugation operations were also checked out and found to be satisfactory. The system is now deemed to be ready for shakedown operationa t 350°C with fused caustic and Illinois No. 6 coal. The test readiness review information and schedule is presented in Appendix A and the test plan submitted for approval to the DOE project officer is presented in Appendix B.

56082 **(PB—82-152851) A review of standards of performance for new stationary sources - coal preparation plants.** (TRW Energy Systems Group, Redondo Beach, CA (USA)). Dec 1980. 93p. NTIS, PC A05/MF A01.

This study has reviewed and assessed the need to revise the new source performance standards (NSPS) for coal preparation plants. These standards limited particulate emissions or opacities from pneumatic coal cleaning equipment, coal dryers, coal processing and conveying, coal storage, and coal transfer and loading. Control device performances have not changed enough to justify changing the particulate standards. Emissions of SO2 are too small to justify setting standards for this pollutant. EPA plans to investigate coal storage piles and unloading stations as unregulated sources of potential particulate fugitive emissions.

56083 **Effects of drying and oxidation on coal pore structure.** Karsner, G.G.; Perlmutter, D.D. (Univ of Pa, Philadelphia, USA). *Industrial and Engineering Chemistry Process Design and Development;* **21**: No. 2, 348-350(Apr 1982).

Pore volume distributions and surface areas were measured by mercury intrusion porosimetry for seven coals of different rank and source location. Both pore volume and surface area are reduced during drying with little additional change during subsequent moderate temperature (<300/degree/C) oxidation. These changes vary with drying severity and initial water content of the coals. 11 refs.

56084 **Coal production and transportation: sixth annual conference, 1980.** San Francisco, CA; PLM, Inc. (1980). 201p. (CONF-8004223—). PLM, INc., 50 California Street, San Francisco, CA 94111.

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The Sixth Annual Conference, Coal Production and Transportation was held April 2-3, 1980 at the Fairmont Hotel, San Francisco, CA. It was sponsored by PLM, Inc. The papers involved mainly: coal's future, EPRI's projection of electrical energy, coal transport on land and on sea, coal car design and manufacturing, and a review of synthetic fuels and coal gasification. Fourteen papers have been entered individually into EDB and ERA. (LTN)

56085 **ICC and coal unit train rates.** Alexis, M. pp 41-57 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The Commission's task in regulating coal rates would be much easier if railroad and shipper were able to contract with each other on all the terms of a unit train tariff. Indeed, because the actual costs of unit train service depend on the specific characteristics of a movement, some form of agreement between shipper and carrier is necessary before unit train service can begin. Among the issues which must be dealt with in addition to the actual unit train rate are: (1) minimum volume requirements and penalty provisions for failure to tender the minimum volume; (2) requirements that shippers provide the freight cars; and (3) switching charges, unloading and detention provisions, and cycle times. Unfortunately, but perhaps predictably, given the major disruptions in the coal ratemaking environment outlined above, shipper and carrier have had difficulty agreeing upon many of these aspects of unit tariffs in the recent cases brought to the Commission for decision. In their negotiations with carriers and their presentations to the Commission, shppers look to the relatively low rates that prevailed before the 4R Act, when coal traffic was dwindling, and seek rates approaching these low levels. Shippers, the Department of Energy, and others argue that rates on coal should be kept low to encourage coal use in accordance with the national energy policy. The railroads, on the other hand, having suffered from abysmal and even negative returns on their capital for decades, seek sizable increases in unit train rates. They argue, often with the support of the Department of Transportation, that railroads must be permitted substantial increases in coal rates to ensure that carriers will have the financial resources to upgrade deteriorated track. Absent substantial investments in rail plant and equipment, they argue, the railroads will not even be capable of carrying the coal required under the national energy policy.

56086 **Comparison of railroad coal unloading systems.** Slater, R.A. pp 61-75 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The proper selection of cars and unloading systems is largely dependent on the economics of travel distances and annual tonnage. However, a variety of geographical factors also influence the proper choice. There is obviously a proper market for each system.

56087 **Use of offshore components for coal cars. Part I.** Acord, F.D. pp 77-84 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The need to utilize foreign components is due to the inability of US foundries to meet the component demand - they are simply booked to capacity. In the last few years there has been increased demand for new cars. This has necessitated heavy orders for the necessary components to build such cars. In addition, there has been a demand for replacement truck components. Most unit trains, for example, are averaging over 100,000 miles per year - that is, four to five times more service than general service cars. This extended service necessitates the availability of more components for maintenance purposes. The soaring demand in freight car orders has resulted in an increased capacity for building cars. However, this increased capacity has been offset by the inability of US manufacturers to produce needed components such as truck sides and bolsters. The end result: an increase in the flow of components from foreign sources. A contributing factor to the US manufacturers' inability to meet this demand was the reduction in productivity due to the number of US foundries that have gone out of business. This was partially a result of stringent EPA and OSHA regulations that jeopardized the livelihood of small producers and curtailed the healthy growth of larger ones. Small foundries also suffered because they couldn't compete with the more modern production facilities during the time of surplus capacity.

56088 **Use of offshore components for coal cars. Part II.** Gak, J. pp 85-89 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

Twenty years after the launching of Cobrasma's operation, it was successfully competing with the oldest and largest manufacturers of railroad equipment in the United States and Europe, both in quality and price. 1970 found Cobrasma in the position of re-evaluating the future of the international market with another important goal - this time, the United States market. Standard Commodities, working exclusively as the extension of the Cobrasma Group in the United States, conducted an exhaustive marketing research as well as a feasibility study of various railroad projects. We arrived at the conclusion that in the immediate future the United States market would be in need of Cobrasma's manufacturing capabilities to help fill the shortage demands of the industry, especially regarding specific types of freight cars. With the full support and cooperation of Cobrasma's management to venture forward with a maximum major effort, the results to date - the continuing performance of deliveries from the factory - have confirmed the choice of this decision. Standard Commodities and Cobrasma are indebted to many United States companies in the railroad industry for their solid support. After 30 months of analysis and evaluation of all the data obtained, it was decided to direct production of car types mainly toward use in transportation of general grain and coal. As in all long-term projects, Cobrasma previously obtained all necessary clearances and approvals before starting to supply various car builders with the most critical items, such as castings, side frames and bolsters, as well as axles.

56089 **Our plans for obtaining, transporting and burning coal along the Gulf Coast.** Kautzman, R.R. pp 99-109 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

Our current fuel mix is comprised solely of oil and gas and a very small amount of hydroelectric. In 1970, 98 percent of our fuel consumed was natural gas, with the remaining 2 percent being oil. Last year our fuel mix was 84 percent gas and 16 percent oil. Our planned fuel use in 1985, as the chart shows, takes into account our first coal and nuclear. The percentage fuel mix then will be 57 percent gas, 13 percent oil, 19 percent coal and 11 percent nuclear. In 1989, coal will begin taking an increasingly higher share of the fuel mix, or about one-third of the Btu's consumed. I may also add that according to the 1980 figure on gas, under current plans a portion of this gas used in our gas boilers may be synthetically derived from coal. I may also add that we're in the process of preparing a system compliance plan for that now and these figures could vary somewhat.

56090 **Coal unit-train tariffs: our experience and my assessment.** Putney, M.W. pp 121-128 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

While many of my comments might be interpreted as harsh and critical of the railroad and the ICC, it should be fully understood that we at Iowa Power strongly support a viable, self-supporting rail system for the transportation of Western coal as well as a strong system for the nation as a whole. We reject unequivocably any attempt to nationalize the rail system, we recognize and support the right of railroads to earn a fair profit. But the coal shipper should not be expected to inequitably subsidize uneconomic commodities or branch lines. From the outset we have rejected the unilateral demands of the railroads without any supporting and fully allocated cost justification. And I would admonish the railroads and the coal producers and anyone else who wants to do business with us, not to ask us to sign any contract or agreement unless that party is willing to live by the terms of that agreement. We are generally pleased with the results to date, although a lot of problems remain ahead. We're optimistic, and we believe these problems can be resolved in the mutual interests of the producer, the shipper, the railroad, and very importantly, the cost-conscious energy consumer.

56091 **Future for US coal exports to southeast Asia: our plans for coal.** Chu, D.S.L. pp 129-135 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

When established in 1946, Taipower operated a war-torn system of 275 MW in installed capacity with only 34 MW in operable conditions. Rehabilitation took almost 5 years. Since 1950, Taipower has been continuously expanding its capacity, so that as of today it has reached 8200 MW. The facilities include such high dams as Techi Dam, a 600-ft high arch dam, one of the highest in the world, such large thermal power plants as the Talin, with 2100 MW in installed capacity and such nuclear power plants as the TPC First Nuclear, which consists of 2 units each rated at 636 MW(e). This system is barely large enough to meet the current power demand. Looking ahead, we will have to triple the system capability in the coming decade to meet the future requirements. The new additions will be mainly nuclear and coal-fired thermal plants. There will be seven nuclear units, of which four are under construction, and twelve coal units, of which two are under construction. We are short of indigenous coal supply. The quantity of the needed coal imports is estimated to increase from 3 million tons/yr in 1980 to 16 MT/yr in 1990 and 32 MT/yr by 1995. The sources of our imported coal, in our opinion, should be Australia, South Africa, Canada and America. It's our plan to construct five coal unloading terminals in the 1980's and a fleet of coal carriers to transport the off-shore coal to our power plants.

0140 Combustion

REFER ALSO TO CITATION(S) 56050, 56057, 56180, 56462, 56710, 56712, 57284, 57746, 57813, 57836, 57841

56092 **(DOE/CS/40037—T13) Pulverized-coal firing of aluminum-melting furnaces. Fourth annual technical progress report, July 1981-June 1982.** Stewart, D.L. Jr.; DeLiso, E.M. (Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.). Jul 1982. Contract AC01-78CS40037. 35p. NTIS, PC A03/MF A01. Order Number DE82019389.

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The Alcoa/GE coal combustor is a two-stage, slagging cyclonic unit designed to direct fire an aluminum melting furnace at a rate of approximately 4.4 mm Btu/h (300 lb coal/h). The coal and an additive to trap sulfur compounds in the slag, is burned substoichiometrically in the first stage at 0.55 0 (55% of stoichiometric air) in the design case. Gaseous products leaving the first stage pass through a short analysis section and into the second stage, where sufficient air to complete combustion (total air = 10% excess) is injected. The hot (> 3000°F) products of combustion pass directly into a melting furnace, which will be a 7-foot diameter ladle for the first combustor (Burner A), and to the stack. Shakedown operations continued during the fourth year of the contracted research and development program. Fifteen coal combustion tests were conducted, but all were terminated before steady-state conditions were attained because of mechanical and refractory problems. Lithium carbonate and calcium carbonate were used in the tests as fluxing/sulfur capture additives. Following relining with a brick more resistant to slag corrosion, shakedown operations will continue.

56093 **(DOE/CS/40037—T14) Pulverized-coal firing of aluminum-melting furnaces. Quarterly technical progress report, January-April 1982.** Stewart, D.L. Jr. (Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.). 1982. Contract AC01-78CS40037. 66p. NTIS, PC A04/MF A01. Order Number DE82019320.

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Three coal combustion tests were conducted but all were terminated before steady-state conditions were attained because of mechanical and refractory problems. Lithium carbonate and calcium carbonate were used as fluxing/sulfur capture additives in the experiments. Shakedown of the system will continue in the next quarter.

56094 **(DOE/MC/14129—1208) Fluidised-bed combustion: combustion of run-of-mine coal in a 12-inch-diameter pressurised fluidised-bed combustor.** Pillai, K.K.; Barker, S.N.; Roberts, A.G. (National Coal Board, Leatherhead (UK). Coal Utilization Research Lab.). 1981. Contract AC21-80MC14129. 76p. NTIS, PC A05/MF A01. Order Number DE82018786.

Direct feeding of run-of-mine (ROM) coal into a pressurized-fluidized bed combustor was performed at the Coal Utilization Research Laboratory; Leatherhead, United Kingdom (U.K.). A twelve-inch diameter rig was operated at 6 atmosphere pressure and 1650°F for a period of eighteen hours. Two coals were used, i.e., a U.K. washed coal for initial proving tests and a Pittsburgh No. 8 coal, both sized one inch to zero. Results were encouraging and are presented.

56095 **(DOE/PC/30295—7) Kinetics of NO/sub x/ formation during early stages of pulverized-coal combustion. Seventh quarterly report, April 1, 1982-June 30, 1982.** Kennedy, J.M.; Chu, E.K.; Pessagno, S.L.; Krill, W.V. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). 28 Jul 1982. Contract AC22-80PC30295. 15p. NTIS, PC A02/MF A01. Order Number DE82018079.

A unique experimental system has been devised to simulate the nearburner combustion environment of a coal particle during its early devolatilization. A stirred reactor is used to characterize the volatilization, evolution of nitrogen-containing gas species, and oxidation of the hydrocarbon and intermediate nitrogen species during the early stages of combustion. Reactor test data are used in developing a kinetic model of these early combustion processes, elucidating the combustion conditions that can be varied to obtain low NO/sub x/ emissions in practical combustion systems. The results are extended to a variety of coal types and compositions. Five additional coal types have been tested and all new test data has been reduced. Trends involving devolatilization and nitrogen specie evolution as a function of particle residence time and reactor stoichiometry are similar among the coal types tested, although varying in magnitude. Correlation of the data for kinetic model development is in progress.

56096 **(DOE/PC/30301—7) CaO interaction in the staged combustion of coal. Seventh quarterly technical progress report, April 1, 1982-June 30, 1982.** Levy, A.; Merryman, E.L.; Rising, B.W. (Battelle Columbus Labs., OH (USA)). 30 Jul 1982. Contract AC22-80PC30301. 26p. NTIS, PC A03/MF A01. Order Number DE82018599.

Efforts were directed to the coal combustion studies. Two modifications were made to the methane-coal (M-C) combustor, one, to allow introduction of the pulverized coal into the early postflame zone of the methane flame (in contrast to preflame injection used in previous runs), and the second to provide better control of the postflame temperature zone. The early postflame injection procedure is being used to reduce the effects of methane chemistry, if any, on the coal combustion process. Control of the postflame temperature is important in studying temperature and residence time effects on sulfur retention chemistry. Five runs were made using the postflame injection method. Pulverized coal treated with lime (Ca/S = 3.8) was burned in the modified methane-coal (M-C) burner to examine the sulfur capture potential of the coal at various temperature and equivalence ratios. Data obtained from the fuel-rich M-C firings continue to show a strong correlation between sulfur retention and carbon burnout of the coal as expressed by the equation, Sulfur retention = -0.827 x Carbon burnout +93.7, where sulfur and carbon burnout are expressed as percent. Lowering the temperature of the postflame reaction zone produced the same sulfur retention-carbon burnout relationship shown above. Analysis of the ashes showed that the sulfur was retained as sulfate with little or no sulfides present. Thus, results from the postflame firings this quarter are in agreement with those from the preflame firings last quarter. Progress has been made in obtaining more reliable analyses of the gaseous sulfur-bearing products (e.g., H_2S, COS and SO_2) formed in fuel-rich firings. However, it appears that the sulfur retention values from the ash data are more reliable.

56097 (DOE/PC/30302—7) Synthetic-fuel aromaticity and staged combustion. Seventh quarterly technical progress report, April 1, 1982-June 30, 1982. Levy, A.; Longanbach, J.R.; Webb, P.R. (Battelle Columbus Labs., OH (USA)). Jul 1982. Contract AC22-80PC30302. 19p. NTIS, PC A02/MF A01. Order Number DE82019583.

The past quarter has been spent improving our laboratory techniques at conditions suitable for studying staged combustion for (1) operating the 1 lb/hr combustor, (2) taking representative HCN, NH_3 and particulate, liquid and gaseous product samples, and (3) analyzing for HCN and NH_3 using specific ion electrodes. Approximately 25 No. 2 oil and SRC-II firings were made for the preceding purposes. No usable results have been obtained so far. The principal problem has been to obtain agreement between measured stoichiometry, based on the O_2 and CO levels in the product gases, and calculated stoichiometry, based on fuel and air flows and fuel analyses. Most of these problems have been related to the operational aspects of the new facility, and not to the chemical aspects of SRC-II combustion.

56098 (DOE/PC/40276—3) Spray combustion of synthetic fuels, Phase II - spray-combustion phenomena. Third quarterly report, 1 April 1982-30 June 1982. (Science Applications, Inc., Chatsworth, CA (USA). Combustion Science and Advanced Technology Dept.). 30 Jul 1982. Contract AC22-81PC40276. 52p. NTIS, PC A03/MF A01. Order Number DE82019588.

An integrated and balanced analytical and experimental program has been structured to provide an understanding of the phenomena involved in the combustion of synthetic fuels and to develop synfuel utilization criteria. An extensive literature search is being conducted to collect and collate available data on the thermodynamics and kinetics or pyrolysis and oxidation for synthetic fuels, related compounds, and baseline fuels. Benchscale experiments will be conducted to obtain data on spray combustion processes. Modular models of the combined aerodynamic and chemical processes of spray combustion are being developed to represent basic combustor configurations. Chemical kinetics formulations are being developed for these models using quasiglobal rate expressions to model pyrolysis, soot formation and oxidation, aliphatic and aromatic compound oxidation and fuel bound nitrogen conversion. The models are being used to assist in the design of the experiments. They will be refined and tested using the results of experiments to be conducted in bench-scale and subscale industrial combustors and using data from other sources. Results of the modeling and experimental program will be used to develop a base of fundamental information relevant to the effective utilization of synfuels in industrial combustion systems.

56099 (DOE/PC/40804—T3) Measurement of solids motion in gas fluidized bed. Technical progress report, 1 March 1982-31 May 1982. Chen, M.M.; Chao, B.T. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 1982. Contract FG22-81PC40804. 16p. NTIS, PC A02/MF A01. Order Number DE82018229.

This technical progress report covers the progress made on the project entitled Measurements of Solids Motion in Gas Fluidized Beds under Grant No. DOE-FG22-81PC40804. The research concerns the measurement of solids, particle velocity distribution, and residence time distribution using the Computer-Aided Particle Tracking Facility (CAPTF) at the University of Illinois at Urbana-Champaign. The design and construction of a 16-in. (nominal diameter) fluidized bed has now been completed. Development of the first phase of the computer program for automatic calibration of the distance-count rate relation required for calculating the tracer location is now complete.

56100 (EPRI-CS—1318) Electric utility use of fireside additives. Final report. Locklin, D.W.; Krause, H.H.; Anson, D.; Reid, W. (Battelle Columbus Labs., OH (USA)). Jan 1980. 303p. NTIS, PC A14/MF A01. Order Number DE82901987.

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Fireside additives have been used or proposed for use in fossil-fired utility boilers to combat a number of problems related to boiler performance and reliability. These problems include corrosion, fouling, superheat control, and acidic emissions. Fuel additivies and other fireside additives have been used mainly with oil firing; however, there is growing experience with additives in coal-firing, especially for flyash conditioning to improve the performance of electrostatic precipitators. In decisions regarding the selection and use of additives, utilities have had to rely extensively on empiricism, due partly to our incomplete understanding of processes involved and partly to the limited amount of quantitative data. The study reported here was sponsored by the Electric Power Research Institute to assemble and analyze pertinent operating experience and to recommend guidelines for utility decisions on the use of additives. This report describes the combined results of the state-of-the-art review of technical literature and a special survey of utility experience. A total of 38 utilities participated in the survey, providing information on trials conducted on 104 units in 93 different plants. Altogether, 445 separate trials were reported, each representing a unit/additive/fuel combination. 90 different additive formulations, both pure compounds and proprietary products, were categorized into 37 generic classes according to their chemical constituents, and the results of the survey are presented by these generic classes. This report is organized according to the operating problems for which fireside additives are used. Guidelines are presented for utility use in additive selection and in planning additive trials.

56101 Design and preliminary results of a fuel flexible industrial gas turbine combustor. Novick, A.S.; Troth, D.L.; Yacobucci, H.G. (GM, Indianapolis, Indiana, USA). *Journal of Engineering for Power;* **104**: No. 2, 368-376(Apr 1982).

The emphasis in this paper is the fuel flexible combustor technology developed under the "Low Nitric Oxide Heavy Fuel Combustor Concept Program" for application to the Detroit Diesel Allison (DDA) Model 570-K industrial gas turbine engine. The technology, to achieve emission goals, emphasizes dry Nitric Oxide reduction methods. 13 refs.

56102 Low No/sub x/ combustion systems for burning heavy residual fuels and high-fuel-bound nitrogen fuels. White, D.J.; Batakis, A.; LeCren, R.T.; Yacobucci, H.G. (Sol Turbine Inc, San Diego, Calif, USA). *Journal of Engineering for Power;* **104**: No. 2, 377-385(Apr 1982).

Novel combustor concepts were designed for dry reduction of thermal NOx, control of NOx from fuels containing high levels of organic nitrogen, and control of smoke from low hydrogen content fuels. These combustor concepts were tested by burning a wide variety of fuels including a middle distillate (ERBS), a petroleum based heavy residual, a coal derived synthetic (SRC-II), and various ratios of blends of these fuels which included nitrogen doping with pyridine. 1 ref.

56103 Naturally occurring high chloride coal and superheater corrosion - a laboratory study. Plumley, A.L.; Roczniak, W.R. (Combust Eng Inc, Windsor, Conn). *American Society of Mechanical Engineers, [Paper];* No. 81-WA/Fu-10, 1-15(1981).

The fireside corrosion potential of commercial boiler tube alloys at elevated temperatures when exposed to the combustion products from a series of coals was investigated. The results of the laboratory and field tests were previously reported. In a supplementary phase of the program, the effect of chloride on similar alloys while firing a naturally occurring high chloride Midwestern bituminous coal in the same laboratory furnace were studied. On the basis of exposure in the convection pass at temperatures from 1100 to

1700 F, Inconel Alloy 690 was very good while Incoloy 800 and Tp-310 S.S. were good transitional materials. Poor materials were T-22, 316S.S., Inconel 617, and Inconel 671. 4 refs.

56104 Direct observations of pulverized coal particles in a combustion environment. McLean, W.J.; Hardesty, D.R.; Pohl, J.H. (Sandia Lab, Livermore, Calif). pp 26p, Paper No. CSS/CI-80-11 of Combustion Institute, Central States Section, spring meeting, 1980. Baton Rouge, LA; Combustion Institute (1980).

From Spring meeting of the Combustion Institute Central States section; Baton Rouge, LA, USA (24 Mar 1980).

Direct observations of the early stages of combustion of size-graded pulverized coal particles are reported. The particles are introduced on the centerline of a high temperature, transparent, laminar flow reactor fed by a gas fueled, premixed flat frame. Photographs of particle emission and high magnification shadowgraphs of burning particles have been obtained. 14 refs.

56105 Small scale combustion tests of solvent refined coal (SRC-II) liquids. Walkauskas, L.P.; Haebig, J.E. (Gulf Res & Dev Co, Pittsburgh, Pa). pp 29p, Paper No. CSS/CI-80-12 of Combustion Institute, Central States Section, spring meeting, 1980. Baton Rouge, LA; Combustion Institute (1980).

From Spring meeting of the Combustion Institute Central States section; Baton Rouge, LA, USA (24 Mar 1980).

Small scale combustion tests of light and heavy coal liquids, produced by the Solvent Refined Coal (SRC-II) process, and standard petroleum fuels were performed to compare soot and NO/sub x/ emissions. Under normal single-stage firing conditions, SRC-II fuels were easily handled and produced no more smoke than comparable petroleum fuels, with the light and heavy fuels (both distillates) yielding smaller particulate loadings than No. 5 oil. 9 refs.

56106 Combustion and agglomeration of coal-oil mixtures in furnace environments. Miyasaka, K.; Law, C.K.; Wang, C.H. (Northwest Univ, Evanston, Ill). pp 23p, Paper No. CSS/CI-80-16 of Combustion Institute, Central States Section, spring meeting, 1980. Baton Rouge, LA; Combustion Institute (1980).

From Spring meeting of the Combustion Institute Central States section; Baton Rouge, LA, USA (24 Mar 1980).

The combustion characteristics of freely-falling and suspended mono-sized coal-oil mixture (COM) droplets in heated air were investigated by studying the quenched samples using scanning electron microscope. Parameters varied include the volatility of the oil, the concentration and size of the coal particles, the residence time, the intensity of blowing, and the effects of water and surfactant addition. 12 refs.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 56073, 56074, 57276

56107 (DOE/EIA—0333) Outlook for US coal. Tukenmez, E.; Paull, M.K. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Aug 1982. 47p. NTIS, PC A03/MF A01. Order Number DE82020509.

This report on the outlook for US coal summarizes the historical development of coal in the United States from both the supply and demand perspectives. The report traces coal use from the 1800's, when it displaced wood, through the 1900's, when oil and natural gas, (cleaner and, until recently, cheaper) became the primary fuels. Projections from EIA's 1981 Annual Report to Congress, Volume 3, show that coal is expected to regain a dominant position as a domestic fuel source. These projections and factors affecting coal's future growth are discussed in this report.

56108 (ESC—9) Coal as an industrial fuel. Bosma, R.; Duijves, K.A. (Stichting Energieonderzoek Centrum Nederland, Petten). May 1981. 104p. (In Dutch). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82902957.

Portions of document are illegible.

This report discusses the potential penetration of coal in the Dutch industrial sector up to the year 2000. In chapter 3 the data collected on energy use in industry in 1977 the industrial energy use of primary fuels was almost completely based on oil and natural gas. Natural gas represented 76% and oil about 15%. The energy consuming equipment in the industrial sector evaluated from an inventory on capacities of steamboilers in the Netherlands. Capacity utilization rates were obtained from other sources. To be able to estimate replacement of equipment, an inventory was made of installed boilers as from 1953. On the basis of an assumed average boiler lifetime of 25 years the replacement could be calculated. Based on this information, assumptions required for the calculation of the amounts of coal that could be introduced were estimated, including the options of enlarging the share of coal by coal gasification and centralized steamraising equipment burning coal. The results indicate that coal gasification will increase the share of coal in industry considerably with a limited increase of SO$_2$ and NO/sub x/ emissions. Two important subjects related to coal use in industry are dealt with: (1) Combined heat and power generation; and (2) coal prices for different users, including costs for handling and transportation. The main conclusion is that the maximum amount of direct coal input in the industrial sector will be more limited than usually expected. Depending on the assumed minimum feasible capacity of coal boilers, the share of direct coal use in the total of primary fuels will range between 25% and 17%. These theoretical amounts will be substantially reduced by various bottlenecks that may appear. The share of coal could be increased considerably by the introduction of coal gasification.

56109 (LA-UR—82-2039) Effect of market structure on international coal trade. Kolstad, C.D.; Abbey, D.S. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 24p. (CONF-8206105—1). NTIS, PC A02/MF A01. Order Number DE82019562.

From IEEE conference; Oxford, UK (28 Jun 1982).

This paper is concerned with the determinants of international steam-coal trade. Most work in projecting coal trade has been either qualitative (a consensus of experts) or, if quantitative, has been based on competitive spatial-equilibrium models. Unfortunately, the competitive model of trade does not appear to account for observed and anticipated trade flows. This is consistent with findings in the commodity trade literature that, although markets may behave in a rational economic fashion, market concentration among producers, traders, and consumers leads to trade patterns significantly different than those associated with competitive markets. The purpose of this paper is to explore the significance and effect on patterns of steam-coal trade of several deviations from the simple competitive model. In addition to perfect competition, we examine monopoly (South Africa) and duopoly (South Africa, Australia) with a competitive fringe (US, Canada, Poland, China and Columbia). Using a simple equilibrium model of coal trade, we examine these market structures and evaluate the extent to which they can explain existing and anticipated trade patterns.

56110 (NP—2903933) Economic-impact study of the expanding coal-mining industry in Tuscaloosa County, Alabama. Mayer, M.L. (Alabama Univ., University (USA). School of Mines and Energy Development). Oct 1980. 30p. NTIS, PC A03/MF A01. Order Number DE82903933.

The purpose of this study was to evaluate the impact of the expanding coal mining industry in Tuscaloosa County upon the economy of the county. The study demonstrates the use of a simultaneous-equation, econometric model for research of this nature. The model takes into account the interrelationships of different sectors of the Tuscaloosa economy and thus provides insight into the cumulative effects of coal mining development in Tuscaloosa. Because the total picture of the county's economy is presented and the impact on all of the relevant variables are taken into account as they are affected by coal mining development, the findings of the study are reliable and extremely useful for comprehensive planning and policy making in the area of industrial development and consumer needs for various social services and facilities (infrastructure and manpower training among others). The approach used in the study is one of general applicability. It can be used, for example, to evaluate stepped-up efforts to export agricultural commodities, the development of industrial parks, and other economic developments impacting the area. A major contribution of this study is the application of the simultaneous-equation methodology to the county level. It is, in fact, a pioneering effort to apply a general system approach to study the impact of economic development (coal mining) in a small area; consequently, the study is a valuable reference for regional planners, especially for economic impact analysis at sub-state level.

56111 **(PB—82-159500) Coal and industry in the Netherlands.** (Centrum voor Energievraagstukken TNO, Apeldoorn (Netherlands)). Mar 1980. 64p. (In Dutch). NTIS, PC A04/MF A01.

Dutch agreements with coal-producing countries and development of activities leading to safeguarding of long-term coal supplies are necessary. The next 20 years coal will be introduced for the generation of electricity and steam, and supply of basic chemicals. Coal gasification with combined cycle electricity generation must be speeded up. How and when central pretreatment of coal can be realized must be studied. This will enable industry to reach a potential level of 8 MtSKE by anno 2000 with modern direct burning technics; industrial application of coal gasification is also desirable. Economic incentives must be considered. Timely provisions must be made concerning logistics of processing of imported coal. The problem of coal waste products and safety and usage must be considered from the start. Government and industry must cooperate in establishing priorities and conditions in coal use implementation. A home market for export of Dutch products and services in coal technology is a requirement. Research, development, demonstration projects and commercial application in coal technology must be established soon. Industrial cooperation and government participation in financial and risk management are necessary. The establishment of a National Energy Fund and the appointment of a Secretary of Energy Affairs are recommended.

0160 Health And Safety

REFER ALSO TO CITATION(S) 56007, 56056, 56072, 57555, 58117, 58252, 58261, 58268

56112 **(AD-A—111449/5) Health safe alarm evaluation. Final report.** Hossain, M.A.; Bishop, E.C. (Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)). Dec 1981. 11p. NTIS, PC A02/MF A01.

The USAF Occupational and Environmental Health Laboratory (USAF OEHL) conducted an evaluation of the National Mine Service Company, Model MX 241, Combination Combustible Gas/Oxygen Deficiency Alarm. The evaluation included determination of linearity of response to a calibration gas (hexane) and the instrument's ability to set the %LEL alarm at or below 5% LEL and oxygen alarm at or below 19.5% oxygen. Recommendation of the MX 241 for specific application was made based upon the evaluation results.

56113 **(PB—82-166505) Foam suppression of respirable coal dust. Final report.** Salyer, I.O.; Sun, S.M.; Schwendeman, J.L.; Wurstner, A.L. (Monsanto Research Corp., Dayton, OH (USA). Dayton Lab.). Dec 1970. 66p. (MRC—6765; MRC-DA—274). NTIS, PC A04/MF A01.

The suppression of respirable coal dust by foam was investigated and a suitable foam formulation was developed after evaluating 40 surfactants for their ability to wet coal. A laboratory model, including a boring machine as coal dust generator, was installed to determine dust reduction under various conditions. It was found that when foam was applied directly to the point of dust formation, over 90% of the respirable dust could be suppressed (initial coal dust concentrations were 350 and 2500 million particles per cubic meter).

56114 **(PB—82-172933) Mining health hazard evaluation report 78-101-100, field study of heat stress at a surface coal mine, Man, West Virginia.** Williams, J.R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1978. 12p. NTIS, PC A02/MF A01.

The level of heat stress was evaluated using two Bendix Electronic Wet Bulb Globe Temperature (WBGT) instruments, two Standard WBGT Set-ups and three Botsballs (WGT). Four types of vehicles were surveyed: (1) 50-ton Kenworth coal truck, (2) 40-ton Cline coal truck, (3) D9 earthmover, and (4) 50 ton 773 Caterpillar rock truck. From a previous NIOSH investigation under similar conditions, a metabolic heat production level of 153 kilocalories per hour (Kcal/hr) was determined for a D9 earthmover operator. This is the value used to determine WBGT Threshold Limit Values (TLVs) and work rest cycles. A Kenworth coal truck, earthmover, and rock truck were studied on July 21, 1978. On both days a WBGT station was set up in the area of operation of an earthmover. Figures 1, 2 and 3 show the dry-bulb temperatures measured for both days. The maximum daily temperature was reached between 3 and 4 p.m. on July 21, 1978. Hourly WBGT time weighted averages were calculated and plotted in Figures 4 and 5. The TLV for continuous work of this type is 88 degrees fahrenheit for workers used to doing this type work in similar conditions (acclimatized). This level was exceeded in the vehicle cab on July 20 by the earthmover and on July 21 by the earthmover and rock truck.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 56452, 58123

56115 **(PB—82-149378) As assessment of development and production potential of federal coal leases.** (Office of Technology Assessment (U.S. Congress), Washington, DC). 1981. 479p. (OTA-M—150). NTIS, PC A21/MF A01.

The main focus of the study is an estimation of the likely production, through 1991, from the existing 548 Federal coal leases in the seven major Western coal states. The likely effects of coal markets, environmental laws and regulations, transportation and socioeconomic factors, and other laws and regulations such as diligence were considered in arriving at production and capacity estimates.

56116 **Coal, coal's future and the US energy policy.** Schmidt, W.B. pp 1-7 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The author emphasizes the cost of petroleum imports to the USA, considers favorable energy conservation results, power plant retrofitting and mandatory regulations in new plants as per the Fuel Use Act of 1978, and gives details of the proposed Synthetic Fuels Corporation for financing synthetic fuels projects. (LTN)

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 56147

56117 (CONF-820712—, pp 152-153) **Evaluation of heavy oil mining within the Continental US.** Riddell, A.W. (Stone & Webster Engineering Corp., Englewood, CO); Piper, E.M.; Trent, R.H. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The objective of this study is to: (1) review past-present and future oil mining project throughout the world and the US in particular; (2) evaluate the potential heavy oil (10 to 20 API) reserves, within certain parameters in the continental US by state, field and reservoir; (3) select suitable sites for applying mining techniques; (4) review mining techniques and equipment in use today and select the most practical methods and equipment; (5) having done this, apply economics to each method and evaluate the final results; and (6) review need for R & D work in mining methods and equipment.

0202 Geology And Exploration

56118 (DOE/BC/10018—20) **Western Gas Sands Project: Los Alamos NMR well-logging tool development.** Jackson, J.A.; Brown, J.A.; Koelle, A.R. (Los Alamos National Lab., NM (USA); Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Aug 1982. Contract AT19-79BC10018. 34p. NTIS, PC A03/MF A01. Order Number DE82020253.

Major advances were made in all areas of the project. Two commercial laboratory NMR spectrometers for core studies were acquired and put into operation. A low-frequency NMR spectrometer was built for core measurements at the operating frequency of the logging tool. A permanent magnet laboratory mockup of the logging tool is being used to measure NMR properties of fluid in saturated Western Gas Sands core. Permanent magnets were acquired that will form the basis for construction of a prototype logging tool. Superconducting magnets for a laboratory mockup of an improved tool have been ordered. Major improvements have been and are being made in the areas of electronics and radio frequency circuitry. A computer control and data acquisition system is assembled and in operation. NMR relaxation times have been measured in standard NMR spectrometer geometry and in inside-out (tool) geometry for water saturated Western Gas Sands core and for synthetic samples. The results correlate well with porosimetry measurements. A program was initiated for theoretial analysis of the data, and it may be possible to generate a computer deconvolution of the NMR relaxation times that can extract pore size distribution from the data.

56119 (USGS-OFR—82-19) **Outer Continental Shelf oil and gas information program. Outer Continental Shelf and onshore oil and gas activities and impacts in the Arctic: a summary report. Update 1, May 1982.** Jackson, J.B.; Pretz, B.C. (Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)). May 1982. 80p. OCS Information, Minerals Management Service, 640 National Center, Reston, VA 22091.

This report was written to provide State and local officials in Alaska and other interested parties with current planning information about oil- and gas-related activities on the North Slope. Although only one exploratory well has been drilled on the Arctic OCS, the area has a long history of oil- and gas-related activities. The State has leased land on the North Slope since 1963, and the discovery of oil and gas at Prudhoe Bay was announced in 1968. The exploration of tracts leased in the Joint Sale and increased oil- and gas-related activity are expected. The amount and pace of development will be determined by the amount of oil and gas discovered in the Arctic; the outcome of existing and proposed litigation; the type of coastal zone management program implemented by the North Slope Borough; and the types of transportation systems built or adopted. Impacts resulting from development will be significant. The physical, biological, and social environments of the Arctic will continue to be altered. However, because of the length of time needed for the planning of new oil- and gas-related facilities in the Arctic, it is unlikely that any new facilities, other than those discussed in this report, will be built during the next 6 months.

56120 **Modeling the dielectric constant of earth-formation rocks: a sandstone memory of immiscible-saturation history.** Yu, J.S. (Sandia Natl Lab, Albuquerque, NM). pp 1057-1060 of Digest of international geoscience and remote sensing symposium (IGARSS '81). Volume 2. New York, NY; IEEE (1981).

From International geoscience and remote sensing symposium; Washington, DC, USA (8 Jun 1981).

Electromagnetic (EM) probings of the earth contribute to the economic exploration and production of geoenergy resources (e.g., gas, oil and geothermal reservoirs). There are two analytical efforts included in one type of EM probing: First, the earth dielectric properties around a borehold are inverted from measurable responses downhole. Second, the gas/oil production parameters are estimated from the inverted dielectric properties of reservoir rocks. As a part of the second effort, this paper gives a modeling procedure with examples on the dielectric constants of three-component rocks made of clean sandstones saturated by oil and water.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 56117, 56173, 56627

56121 (CONF-820712—) **1982 annual heavy oil/EOR contractor reports-proceedings.** (Department of Energy, San Francisco, CA (USA). San Francisco Operations Office). Jul 1982. 245p. NTIS, PC A11/MF A01. Order Number DE82019821.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Portions of document are illegible.

The 1982 Department of Energy Heavy Oil/EOR Meeting for presentations by contractors was held in San Francisco, California, July 27-29. This is the Sixth Annual Presentation by West Coast Contractors to the Department of Energy. The meeting program emphasized the recovery of heavy oil and report were given on enhanced oil recovery (EOR) by applications of thermal processes, chemical flooding, and miscible flooding. Reports included field projects, basic research, and environmental studies. Two presentations were on aspects of heavy oil mining. Twenty five papers and two abstracts of the papers presented at this meeting are in this Proceedings. All papers have been abstracted and indexed.

56122 (CONF-820712—, pp 1-12) **Additives for alkaline recovery of heavy oil.** Radke, C.J. (Lawrence Berkeley Lab., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Recovery of acid oil with simple alkaline agents is economically attractive. However, two major impediments must be overcome. The efficiency of tertiary recovery must be increased and the amount of alkali loss by rock reactions must be reduced. This paper reports preliminary results of using tall-oil pitch and polymers for improving oil recovery behavior and a multivalent cation for suppressing alkaline silica dissolution. When combined with an alkaline-polymer solution, tall-oil pitch at 0.5 w/o concentration recovers around 60% of tertiary oil. Residual oil saturations down to 10% are observed. Since tall-oil pitch is a waste product from sulfite paper manufacture, it is both cheap and available. Further tall-oil pitch is quite compatible with high salinities and temperatures. Addition of alcohol to the alkali-tall oil pitch mixture does not enhance oil recovery. Aluminum cations in concentrations as low as 10 ppM drastically slow the alkaline dissolution of crystalline and amorphous silica. The effect is mainly due to adsorption of aluminum at the silica surface. Although soluble aluminum is produced in-situ in an alkaline flood by slow dissolution of clay minerals, addition of aluminum to the flooding solution seems warranted.

56123 (CONF-820712—, pp 13-28) **Field performance analysis of micellar polymer pilot flood.** Aguey, O.J. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

This paper describes field operations with attendant problems encountered during a micellar polymer flood process in the Hx/sub a/ sand of the Wilmington Field, California. Problems encountered include completion techniques, extreme corrosion, emulsions of produced fluids, and field handling of polymer. The micellar polymer flood described here is Marathon Oil Company's Maraflood (TM) process and was designed by Marathon after much laboratory and field testing. The project was co-sponsored with DOE and the City of Long Beach with the goal of establishing a tertiary oil recovery technique applicable to unconsolidated oil sands typical of the California region. The test pattern selected, after conducting several computer model studies, is a staggered line drive consisting of four injection wells and six producing wells, with all injectors backed up by a North-South trending fault. The sand selected for this pilot is located in the water-out area of the Hx/sub a/ sand of the Upper Terminal V-B Pool. Selection was made because of sand thickness, uniform sand body, good permeability, and because it was a watered out area which would facilitate the project evaluation. The pilot project includes a total oil sand volume of 596 acre-feet underlying an area of about ten acres with an average net sand thickness of 58 feet (17.7m). The permeability to air is about 400 md. The residual oil saturation after water flooding is estimated to be 38%. Recovery to date is estimated to be 38% of the 445 M barrels (70,749 m^3) of oil in place at the beginning of this project. The incremental oil recovery is expected to be 176,000 barrels (27,982 M^3) at abandonment time. The importance of this test is not only to determine the validity of the process in watered out areas of the vast Wilmington Field, but to determine and overcome field operating problems associated with a micellar polymer flood.

56124 (CONF-820712—, pp 29-45) **Alkaline waterflooding demonstration project ranger zone, Long Beach unit, Wilmington Field, California (period May 1981-April 1982).** Kemp, P.B. (City of Long Beach, CA); Mayer, E.H. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Alternating weeks of soft-water alkaline and softwater-salt injection continued throughout the year. As of April 30, 1982, the alkaline slug volume was 20.43 pore volume percent (23,070,842 barrels) which contained 53,017,984 lbs active salt, 17,435,435 lbs active sodium silicate and 19,816,294 lbs active sodium hydroxide. Injection rates through much of 1981 were less than capacity because of water softener plugging and low pressure transfer pump and metering problems. However, the rate in the first four months of 1982 was up to anticipated levels. Laboratory tests indicated that softening of the concentrated brine stream was technically feasible. The reservoir simulation studies were completed. Well work was quite minimal. One new downstructure well was drilled in the northern area's undeveloped portion. One easterly observation injector was redrilled. Otherwise the well work was minor in nature and of a routine type. Twelve wells adjacent to the alkaline injection have shown substantial decreases in water production. The total loss of water rate since August 1981 has been 5000 to 7000 B/D out of a prior total production rate of 17,500 B/D. The well showing these drops and the timing of the declines correspond generally to the time of initial alkaline production forecast by the reservoir simulator. The changes in the trend of wells' monthly produced water chemistry tests in a number of cases correspond to the water productivity drops. No oil rate stimulation has been noted as yet, however.

56125 (CONF-820712—, pp 47-58) **Role of clays in enhanced recovery of petroleum.** Somerton, W.H.; Radke, C.J. (Lawrence Berkeley Lab., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Clays present in oil producing formations may have an important effect on the success or failure of an enhanced recovery operation. The large surface area of clays and the usually high reactivity of these surfaces may lead to loss of injected chemicals by adsorption, exchange or dissolution. Emphasis during the curent year has been on the effects of steaming on the flow and physicochemical behavior or reservoir sands. Core samples have been obtained from the Kern Front and Midway-Sunset fields in California where steaming operations are in progress or may be planned for the future. Results of flow tests on extracted cores showed two different types of behavior. All cores required a period of stabilization to flow of simulated formation brine. After stabilization one set of cores showed a major reduction in permeability when contacted by fresh water while the other cores showed no effect. The cores which were not affected by fresh water showed unusual character of the effluent. pH of the effluent while flowing brine or NaCl solution was low (4 or below). Upon switching flow to fresh water, the effluent pH rose to values of around 7. On the other hand, cores which showed high fresh water sensitivity showed no unusual effluent pH behavior. The above is believed to be a cation exchange phenomenon and to determine whether it was related to steaming of the rock, changing its surface properties, some laboratory steaming tests were conducted. The results were negative in that the flow and pH behavior of the sands did not appear to change after steaming. The presence of oil in the cores did seem to suppress the effects that were observed for extracted cores. Further tests are in progress in an effort to explain these phenomena and to relate them to displacement mechanisms.

56126 (CONF-820712—, pp 59-65) **Bodcau in situ combustion project, Bellevue Field, Louisiana.** Pusch, W.; Dean, M. (Cities Service Co., Jackson, MI). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The Bodcau In Situ Combustion Project is a cooperative venture between Cities Service Company and the Department of Energy. The project is governed by DOE Contract DE-AC03-76ET12057, covering the period from June 1, 1976 through June 30, 1982. The objective is to demonstrate the technical efficiency and economics of a successful commercial scale in situ combustion project utilizing simultaneous air and water injection. The waterflood phase began in October 1980, with the fifth injector converted to water injection only on April 10, 1981. Cumulative injection for the combustion phase was 10 BCF of air and 2.64 MMBW, resulting in 626 MBBL of 19° API crude. Cumulative water injection and oil production through March 1981 was 3.91 MMBW and 693,212 BO, respectively. A performance evaluation was made possible by post burn core and log analyses. Operating expenses and taxes amounted to 8.6 million over project life, an average of $12.47/BBL.

56127 (CONF-820712—, pp 66-73) **Temperature effects on relative permeability of oil-water systems.** Sufi, A.H.; Brigham, W.E. (Stanford Univ., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Relative permeability is perhaps the most important parameter in describing underground flow behavior of immiscible fluids. In recent years, thermal recovery methods have gained in importance. This requires an understanding of temperature effects on flow characteristics of reservoir fluids. This paper presents an experimental study dealing with temperature effects on relative permeabilities of oil-water systems. Results indicate that the curves are independent of temperature as are the end point saturations. There is a decrease in practical residual oil with temperature saturation due to a change in the shape of the fractional flow curve.

56128 (CONF-820712—, pp 74-84) **Surface properties of foaming agents and behavior of foam in porous media.** Sharma, M.K. (Univ. of Florida, Gainesville); Shah, D.O.; Brigham, W.E. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The main objective of the study was to correlate the surface properties of foaming solutions and microscopic characteristics of foam with foam displacement process in a porous medium by measuring breakthrough time and fluid displacement efficiency in anticipation of their application in enhanced heavy oil recovery processes. Based on experimental results, it was observed that the molecular properties of foaming agents and microscopic characteristics of foams showed a strong correlation with the flow behavior of foam in a porous medium. For mixed foaming systems (e.g. $C_{12}H_{25}SO_4Na$ + C/sub n/H/sub 2n+1/OH), a minimum in surface tension, a maximum in surface viscosity, a minimum in bubble size, a maximum in breakthrough time and a maximum in fluid displacement efficiency were observed when both components of the system had same chain length (e.g. $C_{12}H_{25}SO_4Na + C_{12}H_{25}OH$). The effect of temperature on surface properties of foaming solution, average bubble size and fluid recovery was also studied. A decrease in surface tension and average bubble size was observed with raising temperature. Furthermore, the breakthrough time and fluid displacement efficiency in a porous medium increased with increasing temperature. Similar results were obtained with commercial foaming agents. The fluid recovery in presence of foaming agents was found to increase with increasing permeability of a porous medium.

56129 (CONF-820712—, pp 85-97) **Caustic consumption by reservoir rock at elevated temperatures.** Dehghani, K.; Handy, L.L.; Ershaghi, I. (Univ. of Southern California, Los Angeles). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Using an additive with steam requires a good understanding of its chemical reaction with the reservoir rock at steam temperatures. This work is a study of the reaction behavior of caustic solution with reservoir rock at high temperatures. A series of laboratory tests (both static and dynamic) have been conducted on fired and unfired Berea sandstone cores. The static tests show that at 180°C the final caustic concentration or (the final caustic consumption) approaches an equilibrium value. The equilibrium caustic consumption is a linear function of caustic concentration in the range of 0.01 to 0.1 Normal. The dynamic flow tests show a significant rate of dissolution for high temperatures and a lower dissolution rate for the high flood rates. Unfired Berea cores show a higher capacity for ion exchange and a higher consumption than fired Bera cores because of dissolution and precipitation of less soluble alumino-silicate minerals.

56130 (CONF-820712—, pp 98-104) **Williams holding lease steamflood demonstration project Cat Canyon Field, Santa Barbara County, California.** Bardet, C.K.; Adamson, G.R. (Getty Oil Co., Ventura, CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The objective of this pilot program is to evaluate the efficiency and economics of the steam displacement process for future full-scale development of the Cat Canyon S1-B oil sand reservoir and in similar deep heavy crude oil reservoirs. The pilot consists of four inverted five-spot patterns on five acre spacing. Initial steam displacement began in April 1977. Except for brief down-time periods for well and generator maintenance, steam injection was continuous until February 1980, when injection was halted in an attempt to dewater the pilot area. De-watering operations were completed in December 1981. The resumption of steam injection through insulated tubing was initiated in January 1982. Steam injection has been continuous to the date of this publication.

56131 (CONF-820712—, pp 105-112) **200 sand steamflood demonstration project.** Alford, W.O. (Santa Fe Energy Co., Santa Fe Springs, CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Steamflooding generally has been conducted in Midway-Sunset Field reservoirs which have responded favorably to cyclic steam stimulation in order to increase recovery and accelerate cyclic production. Numerous heavy oil pools in this field as well as other fields have not been adequately developed because of poor cyclic steam performance. The Demonstration Project was initiated in the 200 Sand Pool to demonstrate the operational, recovery, and economic aspects of steamflooding a typical heavy oil reservoir which had unfavorable response to cyclic stimulation. This pool, designate the 200 Sand, contains approximately 50 million barrels of oil-in-place in a structure that lies between 400 and 700 feet in depth. The reservoir produced very little primary oil production and responded poorly to cyclic steam stimulation. The project is being conducted in two major phases. The first phase was a pilot test consisting of four (4) 2.35 acre inverted seven-spot steam drive patterns, which were not fully developed with producers (Figure 2). As a result of the response shown by the pilot, in April 1980, the second phase was initiated by beginning work to expand the pilot area to a total of fourteen (14) fully developed 2.35 acre inverted seven-spot patterns (Figure 2). Expansion to a full-scale steamflood test consisted of drilling and completing 30 producing wells and 10 steam injection wells. The 42 pattern producers started receiving cyclic steam stimulation in May 1981. Continuous steam injection in the 14 injectors begin in July 1981.

56132 (CONF-820712—, pp 113-120) **Scaled physical model studies of the steam drive process synopsis of final report, July 1982.** Doscher, T.M. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The principal goal of this project was to gain an understanding of the influence of controllable, operating practices and reservoir parameters on the steam drive. The steam drive, because the chief phenomena of fluid flow and heat flow obey the same laws of diffusion, can be physically scaled. The validity of the results of the scaled physical models is evidenced by the correspondence of the results with those reported in field operations. Results of the studies are discussed under the following headings: gravitational instability of a steam drive; roles of oil viscosity and steam temperature (pressure) on the production of crude oil when the steam flow is stratified; extension of the steam drive to tars and bitumens; occurrence of the optimum steam injection rate; emulsification and oil productivity; steam quality; role of reservoir thickness; cyclic injection of steam in a steam drive; high gravity crudes; partial substitution of inert gas from steam.

56133 (CONF-820712—, pp 121-129) **Analysis of tracer breakthrough curves.** Abbaszadeh-Dehghani, M.; Brigham, W.E. (Stanford Univ., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

This paper discusses tracer flow in layered reservoirs. In the first section of the paper, the previously defined tracer production curves from several homogeneous patterns have been correlated into a single set of curves with Peclet number, a/α, being the parameter. The second section presents an algorithm for layered systems. A computer program based on a non-linear optimization technique was developed which decomposes the tracer breakthrough profile from a multilayered system into responses from individual layers. The program computes porosity-thickness and permeability-thickness for each layer. A five-spot field example which has been successfully decomposed into several layers is shown to illustrate the use of this analysis.

56134 (CONF-820712—, pp 130-139) **Numerical simulation of steam drive with chemical additives.** Eka, A.S.; Dougherty, E. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

A model describing the simultaneous injection of steam and surfactant is presented. The model, which is under development at USC, considers three phase flow of oil, water and gas, with steam as part of the gas phase and surfactant dissolved in the water phase. The model allows the surfactant to partition between the water phase and the rock only. The effects of temperature on viscosity ratio, adsorption kinetics and relative permeability are included. The model considers the effects of dispersion on distribution of the surfactant and the effects of surfactant concentration on oil relative permeability and interfacial tension. New methods for modeling compositional effects and reservoir heat losses are being tested and are presented here.

56135 (CONF-820712—, pp 140-151) **Interfacial tensions of surfactant mixtures against hydrocarbon liquids at elevated temperatures and pressures.** Zekri, A.Y.; Handy, L.L. (Univ. of Southern California, Los Angeles). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Steam injection is the most frequently used process to recover heavy oil. The use of additives to steamfloods has been proposed as a means of improving the recovery efficiency. Surfactants are being evaluated as possible additives which will reduce the residual oil saturation in the region flooded by condensed steam. A critical factor in the success of the process, assuming the chemical is able to contact oil, will be the effect of temperature on the interfacial tension of the surfactant oil system. The effect of temperature on three commercial surfactants (TRS 10 to 80, Petrostep 465, and petrostep 450) were studied. The surfactants were mixed in different proportions to vary the equivalent alkane carbon number. The solution contained 2 g/L of surfactant mixture. Interfacial tensions were measured against n-dodecane and different hydrocarbons. NaCl concentrations were varied from 0 to 20 g/L. Experiments were conducted in the temperature range of 25°C to 180°C using the modified spinning drop tensiometer. Furthermore, the effect of various electrolytes (sodium chloride, sodium sulfate, sodium carbonate and sodium phosphate) on the interfacial tension properties of the solutions was investigated. Of these, sodium chloride gave the lowest interfacial tension at all temperatures. The effect of temperature on EACN was evaluated with a pure surfactant and pure hydrocarbons. The surfactant was a 0.2 wt percent solution of 8-phenyl hexadecane sodium sulfonate in 1.0 wt percent NaCl. Increasing temperature decreased both the observed EACN and also the IFT at the minimum point. Mixtures of anionic surfactant solution have been aged for periods up to a year at room temperature. Interfacial tensions of these aged mixtures were higher than those for fresh solutions.

56136 (CONF-820712—, pp 165-171) **Min-stress II, a new ultrahigh temperature casing packer.** Hirasuna, A.R.; Davis, D.L.; Veal, G.R. (L'Grade,Inc., Newport Beach, CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

An ultrahigh temperature casing packer is being developed specifically for deep enhanced oil recovery (EOR) requirements. The packer is developed around a metal seal, other materials for the expandable seal element being rejected because of their associated unreliability for long-term use in hostile environments. A minimum stress design approach is being applied which results in numerous inherent advantages in the MIN-STRESS II packer. Full-scale prototype development is nearing completion and the packer manufacture and sales rights will be licensed to and commercially available from an established well tool or service company.

56137 (CONF-820712—, pp 182-195) **Evaluation of a conventional steam drive with ancillary materials: North Kern Front Field.** Eson, R.L.; O'Nesky, S.K. (Chemical Oil Recovery Co., Bakersfield, CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Steam drive projects account for over 64% of all of the United States' Enhanced Oil Recovery (EOR) production, nearly 156,000 BOPD. Even though steam drive is the most successful of all EOR processes, it is not without its problems. Gravity segregation and poor areal and vertical sweep efficiencies have limited recoveries in many heavy oil reservoirs. In many instances the injected steam prematurely breaks through into producing wells creating steam channels. If this steam channeling can be controlled to some degree and the steam is forced to contact more of the reservoir, overall recoveries can be improved. This paper documents efforts under a Department of Energy cost sharing contract to reduce steam channeling in a conventional steam drive using ancillary materials. A steam foam solution and a steam foam encapsulated in a polymer gel are being introduced in four steam injection patterns in the North Kern Front Field near Bakersfield, California. The ability of the ancillary materials to improve recovery will be determined through injection profiles, chemical tracer surveys, casing vent gas analyses, core and log data, and residual oil saturation data, as well as through temperature and production monitoring. It has been shown that in-situ steam foams can be used to alter the steam injection profiles to prevent excessive steam channeling. Results after injection of ancillary materials for approximately 18 months indicate that improvements in both the areal and vertical sweep efficiencies have been found in the four treated patterns when compared to the untreated control patterns. Several techniques are still under evaluation to determine the exact amount of incremental oil produced.

56138 (CONF-820712—, pp 196-209) **Field demonstration of steam drive with ancillary materials.** Bowman, R. (CLD Group, Inc., Ventura, CA); Doscher, T.; Kuuskraa, V. Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

This report summarizes the work performed during the third year of a research and development project to demonstrate that a particular ancillary material, surfactant based foam, can improve the efficiency of steam drive. The project consists of basic laboratory testing supplemented by five small field tests. The initial laboratory work involved screening foam chemicals for thermal stability and testing methods of placing them deep into a porous media. Tests were also conducted in a sixteen-foot sandpack to verify the emplacement techniques and the capacity of the chemical system to control the mobility of injected steam. The field tests locations were chosen to address two major technical problems encountered in steam drive operations; namely, the excessive channeling of steam through thief zones, and the progressive increase in steam flow through oil-depeleted, already swept zones. At this time, four mini-tests have been completed although evaluation is continuing; two with Santa Fe Energy in the Midway-Sunset Field, one with Conoco in the Cat Canyon Field and one with Texaco in the San Ardo Field. Another test with Texaco in the San Ardo Field is still underway.

56139 (CONF-820712—, pp 210-218) **Prediction of oil saturation in California sands using the carbon/oxygen log.** Horner, S.G.; Sanyal, S.K. (Stanford Univ., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The objective of this study was to develop a more successful method of determining oil saturation from the data recorded by the Dresser-Atlas Carbon/Oxygen Log. The results are being used in the SUPRI field experiment of in-situ foaming as an enhanced oil recovery technique, in the Kern River Field, Bakersfield, California.

56140 (CONF-820712—, pp 219-226) **Steam-surfactant systems at reservoir conditions.** Wang, P.F.; Al-Khafaji, A.; Castanier, L.M.; Brigham, W.E. (Stanford Univ., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

Mobility control is one of the main problems in steam flooding. Channeling of steam through highly permeable zones and gravity override lead to early steam breakthrough at the production wells. Accordingly, volumetric sweep efficiency and oil recovery are reduced. Foam has been proposed as a permeability blocking agent in steam flooding to improve oil recovery. This paper describes two experiments. One is on static properties of surfactants such a thermal stability, adsorption and partitioning; the other is on dynamic displacement by steam in the presence of surfactants. The aim of this study is to investigate some commercially available and experimental foaming chemicals (surfactants) for their longevity under simulated steam injection conditions, namely at 400°F (205°C) and 300 to 500 psia (20 to 34 bars). The steam injection experiments have been conducted in a linear flow model to study flow behavior, heat transfer and mobility.

56141 (CONF-820712—, pp 227-234) **Foam for gas drive improvement.** Owete, O.S.; Mahmood, S.; Riley, M.; Castanier, L.M.; Brigham, W.E. (Stanford Univ., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

In order to study the flow of foam in porous media for the application of in-situ foaming in enhanced oil recovery processes, several experiments were designed. This paper presents the latest results of a micromodel study directed toward the understanding of the behavior of foam flow in porous media at the pore level and of macroscopic experiments designed to simulate a slice of an oil reservoir. In the latter experiment, emphasis was on slug size and interval determination. The micromodel study showed that a significant reduction in the mobility of a gas is caused by the presence of surfactant and that this reduction can be attributed to different mechanisms. Optimization of the slug size and interval were carried out in a homogeneous sand pack and in a layered system. Both studies showed the importance of proper timing in this process.

56142 (CONF-820712—, pp 235-241) **Design and implementation of a steam-drive pilot with in-situ foaming.** Malito, O.P.; Horner, S.G.; Sanyal, S.K. (Stanford Univ., CA). Jul 1982. NTIS, PC A11/MF A01.

From Annual heavy oil slush EOR contractors conference; San Francisco, CA, USA (27 Jul 1982).

The objective of this field experiment is to test the effectiveness of in-situ foaming as a means of improving heavy oil recovery by steam drive. This experiment is designed to obtain field-scale data unobtainable in a laboratory study. The site consists of two inverted five-spots on 2.25 acre spacing located on the McManus

Lease in the Kern River Field, California. This paper is a summary of the results of the field experiment to date.

56143 (DOE/BC/10033—2) Evaluation of the North Burbank unit tertiary recovery pilot test. Tracy, G.W.; Dauben, D.L. (Keplinger and Associates, Inc., Bartlesville, OK (USA)). Aug 1982. Contract AC19-80BC10033. 29p. NTIS, PC A03/MF A01. Order Number DE82020252.

A review of the performance of the Phillips North Burbank micellar-polymer flood has been completed. The projected ultimate recovery is estimated to be about 300,000 barrels, which is about one half of the initial prediction made by Phillips. Although oil recovery has been less than expected, sufficient additional oil has been recovered to consider the project technically successful. The lower-than-expected oil recovery is attributed principally to high sulfonate losses. Loss of the sulfonate appears to be the result of significant adsorption to the oil-wet pore surfaces and mixing of micellar fluids with in-place water, which is of high salinity and hardness. Contact of the sulfonate with the high concentration of calcium ions creates calcium sulfonate, which either precipitates as an insoluble phase or partitions into the oil phase. Sulfonate partitioning would have created an upper-phase microemulsion, which cannot be easily displaced by water due to the relatively high interfacial tension. The following recommendations are made for improvement of the project: (1) Since preflushes may not always be effective or practical, use a surfactant system which is more tolerant of salinity and hardness. (2) A preflush, if needed, could be improved by designing the volume and salinity of injected fluids to efficiently remove divalent ions from reservoir clays and to displace excess salinity. (3) The surfactant system should be designed with the aid of displacement tests in field cores, conducted over the range of frontal velocities expected in the reservoir. It is particularly important to evaluate displacement at the lower velocity range. (4) Improve operational procedures by conducting workovers prior to pilot initiation and by careful control of injection pressures to insure that fracture extension does not occur.

56144 (DOE/BETC—82/1) Contracts for field projects and supporting research on enhanced oil recovery and improved drilling technology. Progress review No. 29, quarter ending December 31, 1981. Linville, B. (ed.). (Department of Energy, Washington, DC (USA); Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). May 1982. 163p. NTIS, PC A08/MF A01. Order Number DE82016573.

Highlights of progress accomplished during the quarter ending December, 1981, are summarized in this report. Discussion is presented under the following headings: chemical flooding - field projects; chemical flooding - supporting research; carbon dioxide injection - field projects; carbon dioxide injection - supporting research; thermal/heavy oil - field projects and supporting research; resource assessment technology; extraction technology; environmental aspects; petroleum processing technology; microbial enhanced oil recovery; and improved drilling technology. (DMC)

56145 (DOE/MC/08341—43) Field project to obtain pressure core, wireline log, and production test data for evaluation of CO_2 flooding potential. Conoco MCA unit well No. 358, Maljamar Field, Lea County, New Mexico. Final report. Swift, T.E.; Kumar, R.M.; Marlow, R.E.; Wilhelm, M.H. (Gruy Federal, Inc., Houston, TX (USA); Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). Aug 1982. Contract AC21-79MC08341. 221p. NTIS, PC A10/MF A01. Order Number DE82020703.

Portions of document are illegible.

Field operations, which were conducted as a cooperative effort between Conoco and Gruy Federal, began on January 16, 1980 when the well was spudded. The well was drilled to 3692 feet, and 18 cores recovered in 18 core-barrel runs (144 feet). Upon completion of the coring phase, the hole was drilled to a total depth of 4150 feet and a complete suite of geophysical logs was run. Logging was then followed by completion and testing by Conoco. Core porosities agreed well with computed log porosities. Core water saturation and computed log porosities agree fairly well from 3692 to 3712 feet, poorly from 3712 to 3820 feet and in a general way from 4035 to 4107 feet. Computer log analysis techniques did not improve the agreement of log versus core derived water saturations. However, both core and log analysis indicated the ninth zone had the highest residual hydrocarbon saturations. Residual oil saturation were 259 STB/acre-ft for the 4035 - 4055 feet interval, and 150 STB/acre-ft for the 3692 - 3718 feet interval. Nine BOPD was produced from the 4035 - 4055 feet interval and no oil was produced from 3692 to 3718 feet interval, qualitatively confirming the relative oil saturations. The low oil production in the zone from 4022 to 4055 and the lack of production from 3692 to 3718 feet indicated the zone to be at or near residual waterflood conditions as determined by log analysis. 68 figures, 11 tables.

56146 (DOE/SF/10762—2) Field demonstration of the conventional steam drive process with ancillary materials. Second annual report, October 1980-October 1981. Eson, R.L. (Petro-Lewis Corp., Bakersfield, CA (USA)). Jul 1982. Contract FC03-79SF10762. 153p. NTIS, PC A08/MF A01. Order Number DE82020007.

Portions of document are illegible.

This enhanced recovery field demonstration is being conducted in the North Kern Front leases located eight miles north of Bakersfield, California. The primary goal is to evaluate the economic merits of ancillary materials to a conventional steam drive to improve sweep efficiencies. The ancillary materials are used to reduce injection in steam channels. Steam foams have been successfully used as a method of diverting the steam from existing channels. By the end of the second year of the contract, background data has been collected, observation wells have been drilled, four injection well treatments have been designed and started, and a comprehensive monitoring of data is underway. Chemical treatments began in January 1980, and by May 1980, all four treatments were underway. Evaluation of production data plotted by injection pattern shows definite variations in production rates in at least two treated patterns since the initiation of the chemical treatments in early 1980. Estimates of as much as 4560 barrels of incremental oil per day can be attributed during the third quarter of 1981, depending upon the type of production comparison used. Since the completion of the observation wells in late January 1980, five runs of Carbon-Oxygen Logs have been obtained by Dresser Atlas. The computer interpretation (EPILOG) indicates a reduction in residual oil saturations in some intervals. The accuracy of the changes in residual oil saturations, however, cannot be verified until the post pilot wells are drilled adjacent to the observation wells and actual oil saturations are determined from cores. These post pilot wells are expected to be completed by June 1982.

56147 (NP—2905344) Heavy oil in California. Publication No. TR28. Guerard, W.F. Jr. (California Dept. of Conservation, Sacramento (USA). Div. of Oil and Gas). 1982. 16p. NTIS, PC A02/MF A01. Order Number DE82905344.

As of the end of 1980, California's heavy-oil resources were estimated to be between 32 and 42 billion barrels (one barrel equals 42 gallons), compared with about 61 to 66 billion barrels of total oil remaining in place. Although a conservative 1980 estimate of proved heavy-oil reserves indicated 3.5 billion barrels; with increasing prices, it is reasonable to expect an eventual recovery of at least 9 billion barrels. Most of California's heavy oil is in the San Joaquin Valley and the central and southern coastal regions. Kern County, alone, accounts for about 72% of proved heavy-oil reserves in the state. Also, of the 550,000 bpd of heavy crude produced in California in January 1981, Kern County accounted for about 350,000 bpd. Steam stimulation and in-situ combustion methods for recovering heavy crude are discussed briefly. Pumping, treating and shipping, and refining are touched on briefly. Nontechnical and technical constraints to the future recovery of California's heavy crude oil are considered. (LM)

56148 (PB—82-167826) Ecological investigations of petroleum production platforms in the central Gulf of Mexico: volume II. Final report 1978. (Southwest Research Inst., San Antonio, TX (USA)). 1981. 175p. NTIS, PC A08/MF A01.

Surveys of biofouling macroepibiota and fishes were made in June 1978 at four production platforms offshore Louisiana and were supplemented by limited observations made at an additional 15 platforms in August and September of 1978. Biofouling communities of nearshore platforms were dominated by barnacles in terms of biomass, whereas the communities on offshore platforms were dominated by bivalves. Primary production was largely restricted to surface zones of nearshore platforms but at some offshore platforms primary producers were abundant to depths of 30 m.

56149 **Enzymatic method for improving the injectability of polysaccharides.** Compere, A.L.; Griffith, W.L.; Holleman, J.W. (to Department Of Energy). US Patent 4,326,037. 20 Apr 1982. Filed date 1 Nov 1979. vp.

PAT-APPL-090176.

A method for enhancing the ability of polysaccharides in aqueous solution to flow through a porous medium comprises contacting the polysaccharides with an endoenzyme capable of hydrolyzing at least one of the linkages of the sugar units of the polysaccharides and maintaining the polysaccharides in contact with the enzyme under hydrolysis conditions for a time sufficient to decrease the tendency of the polysaccharides to plug the porous medium yet insufficient to decrease the viscosity of the aqueous polysaccharides by more than 25%. The partially hydrolyzed polysaccharides are useful as thickening agents for flooding water used to recover oil from oil-containing subterranean formations.

56150 **Feasibility evaluation of a downhole steam generator.** Wright, D.E.; Binsley, R.L. (Rockwell Int, USA). *Journal of Petroleum Technology;* **34**: No. 4, 881-887(Apr 1982).

A discussion is presented of a downhole steam generator (DHSG); benefits and features are described. The work was done under the management of Sandia Laboratories as part of the U.S. DOE's Project Deep Steam. The effort began with a comparison of alternate ways of generating steam downhole. The most economical was found to be the indirect system, where heat from low-pressure [approximately 5-atm (500-kPal)]combustion of fuel oil and air is transferred to high pressure water. A feasibility test unit was constructed and tested extensively; results are described. Comparative economic analyses indicate that the DHSG is competitive with conventional systems even at moderate depths. Below 2,500 ft (762 m) it is a clear choice. 3 refs.

56151 **Laboratory experiments to evaluate field prospects for CO/sub 2/ flooding.** Orr, F.M. Jr.; Silva, M.K.; Lien, C.L.; Pelletier, M.T. (NM Inst of Min and Technol, Socorro, USA). *Journal of Petroleum Technology;* **34**: No. 4, 888-898(Apr 1982).

A discussion is presented of relationships between the various experiments in the light of current understanding of the mechanisms operating in the CO/sub 2/-flooding process. Objectives and limitation of each experiment are discussed. Limitations on the use of the resulting data to estimate recovery from field CO/sub 2/ floods also are reviewed. A new experimental procedure is described that permits rapid determination of phase behavior and fluid properties of CO/sub 2//crude-oil mixtures at reservoir conditions. The experimental procedure, which involves continuous contacting of the reservoir fluid with CO/sub 2/, can be used efficiently to obtain phase-behavior and fluid-property data that would require difficult and time-consuming experiments if obtained by previously available techniques. 43 refs.

56152 **Fluid-flow monitoring using electromagnetic probing.** Lytle, R.J.; Lager, D.L.; Laine, E.F.; Salisbury, J.D.; Okada, J.T. (Lawrence Livermore Lab., CA). *Geophysical Prospecting;* **29**: 627-638(1981). Contract W-7405-ENG-48.

High-frequency electromagnetic probing is used to monitor the rate and direction of flow of fluids injected into the ground. This method shows the potential for providing more detailed information than procedures presently used. The experimental technique and the test-of-concept experimental results are discussed. This technique has applications in oil-reservoir engineering and in hydrology studies concerning storage of chemical wastes.

0204 Processing

REFER ALSO TO CITATION(S) 56144, 57565

56153 **(DOE/RG/10071—T1) Evaluation of Gulf Oil Corporation petition for permanent exemption from the Fuel Use Act for new steam generating facilities at Alliance Refinery Belle Chasse, Louisiana.** (Gibbs and Hill, Inc., New York (USA)). Sep 1981. Contract AC01-81RG10071. 81p. NTIS, PC A05/MF A01. Order Number DE82000322.

Gulf Oil Corporation has filed a petition for permanent exemption from the prohibitions of the Fuel Use Act for a new steam generating facility at its Alliance Refinery in Plaquemines County, Louisiana. A new boiler is proposed which will generate 400,000 lb/h of steam to satisfy new process units and provide back-up for existing steam generation facilities. A Base Case utilizing refinery fuel oil (RFO) and seven (7) alternatives involving coal, coke, and mixtures of coal-RFO and coke-RFO are investigated. The eight (8) alternatives are reviewed and tabulations are presented that summarize capital costs, annual operating costs (excluding fuel cost), and solid waste quantities. Estimated capital and operating costs for a flue gas desulfurization (FGD) system to serve the RFO-fired boiler if the fuel contained the maximum 1.2% sulfur are provided. These costs are also summarized. A description of the required FGD facility is provided.

0205 Products And By-products

56154 **Tertiary nitrogen heterocyclic material to reduce moisture-induced damage in asphalt-aggregate mixtures.** Petersen, J.C.; Plancher, H. (to Department Of Energy). US Patent 4,325,738. 20 Apr 1982. Filed date 15 Jan 1981. vp.

PAT-APPL-225219.

Asphalt-aggregate roads crack when subjected to freezing and thawing cycles. Herein, the useful life of asphalts are substantially improved by a minor amount of a moisture damage inhibiting agent selected from compounds having a pyridine moiety , including acid salts of such compounds. A shale oil fraction may serve as the source of the improving agent and may simply be blended with conventional petroleum asphalts.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 56051, 56117, 57112

56155 **(PB—82-159005) Establishing a reliable source of fuel for Department of Defense requirements: Effective petroleum, oil, and lubricant financial managment. Final report.** Scherer, T.F. (American Univ., Washington, DC. Inst. for Applied Public Financial Management). Dec 1981. 85p. NTIS, PC A05/MF A01.

The Defense Fuel Supply Center (DFSC) is the management and procurement agency for petroleum for the Department of Defense. Its mission is to procure refined petroleum products to meet military service requirements worldwide and federal requirements within the United States. The procurement options analyzed are divided into two categories -- direct and indirect methods of acquiring products. Through the analysis discussed, it will be shown that the only viable solution to DFSC's problem lies in purchasing the desired quantities using direct acquisition methods by reducing the cost incurred to a refiner for supplying military products.

56156 **(PB—82-159690) Effects of the existing Norwegian petroleum tax system on recovery.** Asheim, G.B. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Nov 1981. 27p. (CMI—812010-4). NTIS, PC A03/MF A01.

The existing Norwegian petroleum tax system is considered through an analytical approach. It is shown that royalty, tax reducing allowances and escalating state participation have distortive effects that may prevent the attainment of a socially optimal recovery factor.

56157 (PB—82-159740) **World oil futures: results from the OILTANK model presented at the energy modeling forum.** Ervik, L.K.; Johannessen, O.; Nunn, D.W. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Sep 1980. 101p. (CMI—802210-4). NTIS, PC A06/MF A01.

This report gives results from the OILTANK simulation model presented at the Energy Modeling Forum on future world oil price. 12 scenarios are presented.

56158 (PB—82-162033) **World oil futures: a summary of the basic oiltank model presented at the energy modeling forum.** Ervik, L.K.; Johannessen, O.; Nunn, D.W. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Dec 1980. 31p. (CMI—802210-5). NTIS, PC A03/MF A01.

OILTANK is a continuous simulation model integrated with a Linear Programming routine which calculates transportation requirements. It is also formulated as a Monte Carlo simulation model with uncertainty explicitly formulated in some 300 variables. The world is divided into 16 fully formulated consumption and production regions. The choice of regions is intended to separate the largest oil consumption and production areas geographically, while still allowing explicit representation of political or economic groupings of interest.

56159 (PB—82-162926) **Economic analysis of the North Sea oil and gas region.** Nystad, A.N. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). 20 Feb 1981. 46p. (CMI—802310-3). NTIS, PC A03/MF A01.

This study looks into the economics of 27 North Sea oil and gas fields in the U.K. and Norwegian sectors based on the most recent cost and investment estimates together with the expected production profiles. A sensitivity study of each project is presented including an economic analysis of the recent changes in the fiscal regime in both sectors during 1979/80 as well as a cost study considering general up-to-date statistics, the recent developments concerning cost escalations and some cost correlations. Finally the North Sea reserves and supply potentials are discussed.

56160 (PB—82-162934) **Supply of world oil qualities.** Ervik, L.K.; Hageselle, A. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Feb 1981. 37p. (CMI—812260-6). NTIS, PC A03/MF A01.

OILTANK is a continuous simulation model integrated with a Linear Programming routine which calculates transportation requirements. It is also formulated as a Monte Carlo simulation model with uncertainty explicitly formulated in some 300 variables. The world is divided into 16 fully formulated consumption and production regions. The choice of regions is intended to separate the largest oil consumption and production areas geographically, while still allowing explicit representation of political or economic groupings of interest.

56161 (PB—82-180209) **Analysis of oil supply disruption scenarios. Final report.** Mork, K.A. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). 10 Apr 1981. 42p. (MIT-EL—81-010). NTIS, PC A03/MF A01.

This report brings the results of simulations of some oil supply disruptions on the M.I.T. Energy Laboratory Energy Macro Model. This model has previously been used to study the macroeconomic effects of the 1973-74 and 1979 oil price shocks, as well as for policy simulations related to these historical events. Recent extensions of the model allow it to be used for simulation of possible future oil supply disruptions, such as the loss of oil deliveries from Saudi Arabia or the entire Persian Gulf region.

0208 Waste Management

REFER ALSO TO CITATION(S) 56101, 56102, 58141

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 56051, 56057, 56105, 56144, 57746, 58141, 58151, 58177, 58178, 58267

56162 (FWS/OBS—82/20) **Marine birds of the southeastern United States and Gulf of Mexico. Part II. Anseriformes.** Clapp, R.B.; Morgan-Jacobs, D.; Banks, R.C. (National Museum of Natural History, Washington, DC (USA)). Jul 1982. 505p. National Coastal Ecosystems Team, Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458.

Information on the seasonal distribution and abundance of 41 species of waterfowl of the order Anseriformes that occur in the coastal southeastern United States has been compiled and mapped from the literature. In many instances this provides the first synthesis of knowledge about a species for this region. For the species we consider most important in coastal areas we also provide information on world-wide distribution, habitat, food, and various aspects of life history. This information was gathered in an attempt to assess the possible effects of offshore oil development on populations of marine birds in the southeast. The susceptibility of birds to oil depends not only on their juxtaposition in time and space, but also on currents and climatic factors and on the stage of the life or annual cycle and the behavior of the species. Contamination by oil may result in matting of the feathers with death following from chilling, starvation, and the ingestion of oil during preening. Among the birds covered by this report, the sea ducks and diving ducks are considered the most susceptible to oil pollution in the southeast. Most of the other ducks, geese, and swans covered in the report are relatively insusceptible to oil pollution because they are seldom found in areas where oiling is likely to occur. One of the conclusions reached by this report is that we know very little about the status and populations of some of the anatids that occur in the southeast. Some of these species (e.g., the scoters) are among those that may be expected to be most detrimentally affected by development of oil resources. In general, most species that are widely hunted are relatively well studied, but much is unknown of those that are not game birds.

56163 (IVL-B—629) **Biological effects of three different shoreline cleanup methods.** Mattsson, J.; Lethinen, C.; Linden, O. (Swedish Water and Air Pollution Research Lab., Studsvik). Jun 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750484.

In order to simulate a real oil spill the shore of a small island in the Baltic proper was treated with a weathered crude oil. The aim of the study was to investigate and compare environmental impact of some shoreline cleanup techniques as well as the effectiveness of these methods. Hot water was the quickest cleanup method, whereas cleaning with a solvent took twice as much time and mechanical recovery three and a half time as much. The hot water treatment resulted in the smallest amounts of oil left in the soil compared to the two other methods, where two to three times as much was left. The oil content in sedimenting material and in mussels was highest outside the area cleaned with hot water. The oil content in mussel tissues increased 75 times after cleaning and the sediment contained about twice as much oil as outside the other areas. The vegetation on all four oiled areas was considerably reduced and the soil fauna was completely eliminated. Since no animals were found on the four oiled areas, not even on the untreated area, it appeared to be the oil itself that caused this effect. The number of animals caught with pitfall traps decreased after oiling and cleanup to between 10-40 % of the original amount. The results from the investigation of the fauna in the Cladophora-belt do not indicate any effects so far.

56164 (PB—81-225732) **EnvironmentAl assessment of the Alaskan continental shelf: annual reports of principal investigators for the year ending March 1980. Volume 5: hazards.** (National Oceanic and Atmospheric Administration, Boulder, CO (USA)). Feb 1981. 665p. NTIS, PC A99/MF A01.

Hazards caused by the environmental conditions are reported. Environmental pollution resulting from the development of oil and gas resources in Alaskan waters was investigated.

56165 (PB—82-161621) An introduction to the environmental literature of the Mississippi Deltaic Plain Region. van Beek, J.L.; Davis, D.J.; Emmer, R.E.; Hsu, S.A.; Mendelssohn, I.A. (Coastal Environments, Inc., Baton Rouge, LA (USA)). Oct 1981. 213p. NTIS, PC A10/MF A01.

This report is a review of selected environmental literature of the Mississippi Deltaic Plain Region. This review introduces some of the major ecosystem components and processes, describes oil and gas production activities, and guides the reader to available literature.

56166 (PB—82-167800) Ecological investigations of petroleum production platforms in the central Gulf of Mexico: volume I, part 6 and 7. Final report 1978. (Southwest Research Inst., San Antonio, TX (USA)). 1981. 522p. NTIS, PC A22/MF A01.

Twenty-four sites on the continental shelf of the Louisiana coast have been studied for long-term cumulative efforts of petroleum production in the region of offshore platforms. Four primary study platforms and four control sites were visited in May 1978, August/September, 1978, and January 1979. Sixteen secondary platforms were sampled August/September 1978. This volume presents the findings of the benthic biology/histology study efforts.

56167 (PB—82-171794) Environmental assessment of the Alaskan Continental Shelf. Volume 5. Biological studies: assessment of available literature on effects of oil pollution on biota in arctic and subarctic waters. Final report 1 Jul 75-30 Sep 76. Malins, D.C. (National Marine Fisheries Service, Seattle, WA (USA)). Mar 1979. 716p. NTIS, PC A99/MF A01.

The report describes the potential sources and levels of trace metals in the marine environment and their potential biological effects in relation to petroleum drilling and transport operations in arctic and subarctic environments. Four metals--cadmium, lead, chromium, and nickel--were chosen for detailed study in relation to their biological effects on organisms.

56168 (PB—82-176488) Barge Ocean 250 gasoline spill. Griswold, C.A. (National Marine Fisheries Service, Seattle, WA (USA)). Nov 1981. 38p. (NOAA-TR-NMFS-SSRF—751). NTIS, PC A03/MF A01.

On 16 March 1978, the barge Ocean 250 grounded on Watch Hill Reef, 1,006 m off Watch Hill, Rhode Island. An estimated 2.6 million liters of gasoline was spilled into Block Island Sound. Results of cytogenetic analyses indicated maximum damage occurred in fish eggs. Membrane or embryo damage occurred in up to 100% of the fourbeard rockling, Enchelyopus cimbrius, and yellowtail flounder, Limanda ferruginea, eggs collected over a 4 day period following the spill. Twenty-three fish samples representing 10 species were analyzed. With the exception of localized damage to fish eggs, there was no apparent discernible damage to fish or invertebrate populations in the area immediately following the spill.

56169 (PB—82-185638) Environmental assessment of the Alaskan Continental Shelf: final reports of principal investigators, volume 12. Biological studies. Hunt, G.L.; Blackburn, J.E.; Rogers, D.E. (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Marine Pollution Assessment). Aug 1981. 713p. NTIS, PC A99/MF A01.

This report contains results on: reproductive ecology, foods and foraging areas of seabirds nesting on the Pribilof Islands, 1975-1979; Pelagic and Demersal Fish assessment in the Lower Cook Inlet estuary system; Epipelagic meroplankton, juvenile fish, and forage fish: Distribution and relative abundance in coastal waters near Yakutat.

56170 (PB—82-185646) Environmental assessment of the Alaskan Continental Shelf: final reports of principal investigators, volume 13. Biological studies. McCain, B.B.; Horner, R.A.; Ainley, D.G.; Dunn, J.R.; Kendall, A.W. (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Marine Pollution Assessment). Oct 1981. 848p. NTIS, PC A99/MF A01.

This report contains results of studies on: the frequency and pathology of marine fish diseases in the Bering Sea, Gulf of Alaska, Norton Sound, and Chukchi Sea; Beaufort sea plankton; influence of petroleum on egg formation and embryonic development in seabirds; seasonal composition and food web relationships of marine organisms in the nearshore zone-; taxonomic composition, seasonal distribution, and abundance of ichthyoplankton in the nearshore zone of the kodiak archipelago, Alaska.

56171 (PB—82-185653) Environmental assessment of the Alaskan Continental Shelf: final reports of principal investigators, Volume 16. Biological studies. Hunt, G.L.; Kaiwi, J.; Schneider, D.; Sanger, G.A.; Patten, S.M. (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Marine Pollution Assessment). Jan 1982. 609p. NTIS, PC A99/MF A01.

This report contains results of studies on: pelagic distribution of marine birds and analysis of encounter probability for the Southeastern Bering Sea; the winter feeding ecology and trophic relationships of marine birds in Kachemak Bay, AK; seasonal use of coastal habitat from Yakutat Bay to Cape Fairweather by migratory seabirds, shorebirds and waterfowl.

56172 Biodegradation and gas-exchange of gaseous alkanes in model estuarine ecosystems. Bopp, R.F.; Santschi, P.H.; Li, Y.H.; Deck, B.L. (Columbia Univ, Palisades, NY, USA). *Organic Geochemistry;* 3: No. 1-2, 9-14(Jan-Apr 1981).

Gas exchange-biodegradation experiments conducted in model estuarine ecosystems indicate that the ease of degradation of gaseous normal alkanes increases with chain length. The behavior of gaseous perhalogenated alkanes can be explained by gas exchange alone with no degradation. The initial degradation of C/sub 3/ and C/sub 4/ alkanes proceeded with half times of a few days to a few weeks. However, after a period of 15-30 days, the rate of degradation increased by at least an order of magnitude. Refs.

0210 Legislation And Regulation

56173 (PB—82-158064) Pitfalls in Interior's new accelerated offshore leasing program require attention. (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 18 Dec 1981. 100p. (EMD—82-26). NTIS, PC A05/MF A01.

The report discusses the Interior Department's new proposed 5-year offshore oil and gas leasing and development program. Significant changes in the program and the associated problems and issues that could affect the accomplishment of program goals are highlighted.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 56119

0230 Properties

REFER ALSO TO CITATION(S) 56028, 57543

56174 (AD-A—110917/2) Investigation of the application of a cryogenic blending process to produce antimisting diesel fuels. Final report. Hadermann, A.F.; Waters, P.; Trippe, J.C.; Weitzen, W. (General Technology Applications, Inc., Arlington, VA (USA)). 15 Jan 1982. 65p. NTIS, PC A04/MF A01.

Fire-resistant fuels have been investigated by the United States Army as a means of reducing the risk of fire in land combat vehicles and certain aircraft. One approach has been the use of high-molecular-weight polymer additives for suppression of mist formations. The polymers which are effective in mist suppression are very difficult to dissolve in fuel. A newly discovered process for dissolving high-molecular-weight polymers is investigated to determine its applicability to the preparation of mist suppression fuels. The conclusions are that certain high-molecular-weight polymers which show strong mist suppression behavior can be dissolved rapidly in diesel fuel and that the new dissolving process appears to be adaptable to field use.

56175 (PB—82-174285) The rational utilisation of fuels in private transport (RUFIT): extrapolation to unleaded gasoline case. (CONCAWE, The Hague (Netherlands)). [nd]. 21p. (CONCAWE—8/80). NTIS, PC A02/MF A01.

The Energy Directorate of the European Economic Commission (EEC) requested the petroleum and automobile manufacturing industries to conduct a study into these relationships to obtain a rational planning basis for any future legislative actions dealing with vehicle exhaust emissions and energy conservation. In response to this request the CCMC (Comite des Constructeurs du Marche Commun) issued a report. The purpose of the current report is to describe the basic methodology of these joint studies, the main results concerning gasolines containing 0.6 - 0.15 g Pb/L, and the best estimates obtained by extrapolating the refining study (2) to an unleaded gasoline situation.

0240 Storage

REFER ALSO TO CITATION(S) 57109

56176 (DOE/EP—0046/1) Strategic petroleum reserve. Quarterly report. (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). 17 May 1982. 14p. NTIS, PC A02/MF A01. Order Number DE82015444.

During the first quarter of 1982, the Department of Energy continued to expand the storage capacity for the Strategic Petroleum Reserve (SPR) and to take advantage of the favorable international oil market for the purchase of oil to fill the Reserve. The SPR is being developed in three phases and the cumulative fill capability for storage of crude oil for the SPR is expected to be 750 million barrels by 1990. As of March 31, 1982, the cumulative fill capability was 260 million barrels. Development of Phase I of the program consisting of 250 million barrels of capacity is complete and development of Phase II, consisting of 290 million barrels of capacity is continuing. During 1981, the design of Phase III commenced. Phase III will increase the SPR capacity by 210 million barrels. The Phase III drilling contract for Bryan Mound was awarded in February 1982 with drilling scheduled to start on July 15, 1982. Market conditions continued to be favorable for the purchases of oil to fill available SPR storage capacity. The SPR was filled at a rate of 202,188 barrels per day during the calendar quarter ending March 31, 1982, and the total SPR crude oil inventory at the end of this period was 248,537,469 barrels. The weighted average cost of crude oil delivered to SPR terminals from January 1, 1982 to March 31, 1982, was $35.61 per barrel.

56177 (PB—82-152224) Strategic Petroleum Reserve: Substantial progress made, but capacity and oil quality concerns remain. Report to the Congress. (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 31 Dec 1981. 65p. (EMD—82-19). NTIS, PC A04/MF A01.

The report discusses efforts since July 1980 to fill the reserve. It makes recommendations to the Secretary of Energy concerning the availability of storage capacity and the quality of oil stored in the reserve. It also includes matters for consideration by the Congress during the fiscal year 1983 budget process.

56178 Use of hybrid fuel in a single-cylinder diesel engine. Ryan, T.W.; Likos, W.E.; Moses, C.A. (Southwest Res Inst, San Antonio, Tex). pp 24p, Paper No. CSS/CI-80-06 of Combustion Institute, Central States Section, spring meeting, 1980. Baton Rouge, LA; Combustion Institute (1980).

From Spring meeting of the Combustion Institute Central States section; Baton Rouge, LA, USA (24 Mar 1980).

Several nonpetroleum-derived materials have been blended with diesel fuel and tested in a single-cylinder diesel engine. The fuel formulations consisted of slurries of solids and solutions of liquid components. Preliminary screening tests have indicated that in many cases the thermal efficiency is increased. Minor changes, however, must be made in the injection system and upper limits must be placed on particle sizes present in the slurry fuels. 5 refs.

0250 Combustion

REFER ALSO TO CITATION(S) 56057, 56100, 56101, 56102, 56105, 56106, 56458, 57837, 57838, 57839

56179 (AD-A—111151/7) Design of an apparatus for the study of electrostatic effects on gas turbine fuel sprays and combustion efficiency. Master's thesis. Todd, L.L. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1981. 37p. NTIS, PC A03/MF A01.

The theoretical effects of an electrostatic field on the atomization process of a fuel nozzle and the resulting change in flame characteristics and combustion efficiency which can be expected are presented. Included are a discussion of the atomization process, electrostatic effects on fuel droplet size, and combustion of a fuel droplet. To demonstrate electrostatic effects on atomization, a model jet engine combustion chamber was constructed which performed effectively. However, during attempts to introduce the necessary high electric field, the flame grounded the voltage and no definitive results have been obtained.

56180 Low NO/sub x/ and fuel flexible gas turbine combustors. Lew, H.G.; DeCorso, S.M.; Vermes, G.; Carl, D.; Havener, W.J.; Schwab, J.; Notardonato, J. (Westinghouse Electr Corp, Concordville, Pa, USA). *Journal of Engineering for Power;* **104**: No. 2, 303-313(Apr 1982).

The work described in this paper is a part of the DOE/LeRC "Advanced Conversion Technology Project" (ACT). The program is a multiple contract effort with funding provided by the Department of Energy and technical program management provided by NASA LeRC. Testing has been done burning a petroleum distillate fuel, a coal derived fuel, a petroleum residual fuel, and various blends of these fuels. 12 refs.

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 56119, 56120

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 56173

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 56051, 56159

56181 (DOE/EIA—0188-81) US imports and exports of natural gas, 1981. Dillard, F.B. (Department of Energy, Washington, DC (USA). Energy Information Administration). Jun 1982. 38p. NTIS, PC A03/MF A01. Order Number DE82020271.

Portions of document are illegible.

Natural gas imports accounted for approximately 4% of the total estimated US natural gas supply in 1981. Imports of natural gas (as a percent of total supply) were at the lowest level in a decade. The combined volume of natural gas imports by pipeline and by LNG shipment in 1981 amounted to 904.0 billion cubic feet. This represented a decrease of 8.2% from the 1980 volume of 984.8 billion cubic feet. Imports of LNG from Algeria sharply decreased, totaling only 36.8 billion cubic feet in 1981, as compared with 85.9 billion cubic feet in 1980. This 57.1% decrease in imports of Algerian LNG accounts for more than one-half of the total reduction in natural gas imports during the 1981 reporting period. A small amount of LNG (6 million cubic feet) was delivered by truck from Canada in 1981. In contrast, exports of pipeline natural gas and LNG increased by 21.9% during the same period, from 48.7 billion cubic feet in 1980 to 59.4 billion cubic feet in 1981. Exports of LNG to Japan from Southern Alaska increased from 44.7 billion cubic feet in 1980 to 55.9 billion cubic feet in 1981. Net imports of natural gas (i.e., imports less exports) thus decreased by 10.0%, from 936.0 billion cubic feet in 1980 to 844.5 billion cubic feet in 1981. The flow of US natural gas imports and exports during the year and the volumes and average prices of total natural gas imports and exports over the past 10 years are shown. Detailed historical data for the years 1955 to 1981 are provided in tabular form.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 56051, 56164, 58097, 58098

56182 (UCRL—87256) Numerical simulations of atmospheric releases of heavy gases over variable terrain. Chan, S.T.; Rodean, H.C.; Ermak, D.L. (Lawrence Livermore National Lab., CA (USA)). Aug 1982. Contract W-7405-ENG-48. 34p. (CONF-820936—2). NTIS, PC A03/MF A01. Order Number DE82020351.

From 13. international technical meeting on air pollution modeling and its application; Toulon, France (14 Sep 1982).

In this report, a three-dimensional, conservation equation model for simulating the dispersion of heavy gases has been described and used to simulate the vapor dispersion of two markedly different (regarding the role of gravity-flow) LNG spill experiments. Two numerical simulations of the NG dispersion were carried out for each experiment. The first assumed a flat terrain and the second used a numerical simulation of the actual terrain at the test site. In general, good agreement between model predictions and field measurements, regarding maximum downwind distances to the LFL, time histories of temperature and concentration at several representative locations, and concentration contours on certain horizontal and crosswind surfaces was observed. The overall results obtained in the model calculations with the simulated actual topography were shown to correlate much better with the field data and, in particular, many important features of the vapor cloud observed under the light wind conditions of Burro 8 were reproduced in the variable terrain simulation. These include the vortex-induced high concentration regions resulting in the bifurcation of the NG cloud and the deflection of the NG cloud due to sloping terrain.

56183 (UCRL—87667) Determining the potential damage from LNG vapor-cloud fires: what are the unanswered questions. Hogan, W.J. (Lawrence Livermore National Lab., CA (USA)). May 1982. Contract W-7405-ENG-48. 14p. (CONF-820377—1). NTIS, PC A02/MF A01. Order Number DE82015921.

From Gas Research Institute workshop on fire and radiation; Boston, MA, USA (21 Mar 1982).

When LNG spills in an accident but is not ignited immediately, the vapor cloud will mix with air and form a combustible mixture whose size, shape, and homogeneity depends on the amount of material spilled, the rate of vapor evolution, and the atmospheric and environmental conditions. If the combustible mixture subsequently ignites, damage can result from overpressure or thermal energy. Overpressure can be generated if there is either direct shock initiation of a detonation or if there is sufficient flame acceleration. Discussion on damage from thermal energy into two categories, that occuring within the burn zone itself and that occurring outside of it. Results of experiments on flame acceleration and thermal damage are discussed. Recommendations are made for further research.

0309 Artificial Stimulation

56184 (PB—82-168436) Development of technology for coalbed methane recovery program planning. Technical report (final) Sep 80-Jul 81. Gillies, A.; Snygg, A. (TRW Energy Engineering Div., McLean, VA (USA)). Jun 1981. 215p. NTIS, PC A10/MF A01.

A program option for the development of technology for economic recovery of coalbed methane was developed during the course of this study. As a first step in the planning process, an assessment of technology currently used in the oil and gas industry was conducted to determine its suitability for use in recovery of methane from coalbeds. It was determined that the most limiting technology was stimulation of water and gas flow from the deeper, more gassy, coal formations. Twenty RandD projects addressing stimulation techniques and related topics were selected by the GRI and the GRI project advisors and plans for their conduct developed. These individual project plans were consolidated into a representative program plan option which describes how the individual stimulation tests can be integrated into three types of production scale tests--each targeted at a particular class of coal formation.

56185 (PB—82-169699) Development of technology for coalbed methane recovery program planning: appendix A. technology options. Final report. (TRW Energy Engineering Div., McLean, VA (USA)). Dec 1981. 60p. NTIS, PC A04/MF A01.

This appendix contains summary descriptions of technology options examined under Task 1 of the coalbed methane technology development study.

56186 In-situ stresses: the predominant influence on hydraulic fracture containment. Warpinski, N.R.; Schmidt, R.A.; Northrop, D.A. (Sandia Natl Lab). *Journal of Petroleum Technology;* **34**: No. 3, 653-664(Mar 1982).

In-situ experiments, which are accessible by mineback, have been conducted to determine the parameters that control hydraulic fracture containment. These experiments demonstrate that a stress contrast between the pay zone and a bounding layer is the most important factor controlling fracture height. Material property interfaces are shown to have little effect. 19 refs.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 56173

56187 (AD-A—111561/7) Off-gas provisions of the Powerplant and Industrial Fuel Use Act. (Vermont Univ., Burlington (USA). Dept. of Physics). 15 Dec 1981. 11p. NTIS, PC A02/MF A01.

Because the Fuel Use Act (FUA) prohibitions on electric utility natural gas use were repealed as part of the Omnibus Budget Reconciliation Act of 1981 (House Report 97-208, Sec. 1021), we prepared this letter summarizing our findings on FUA's 'off-gas' provisions primarily for informational purposes. The 'off-gas' provisions of FUA were designed to (1) conserve natural gas for uses other than the generation of electricity; (2) encourage the use of coal or other alternative fuels in place of natural gas; and (3) ensure natural gas availability for high priority purposes. The 'off-gas' provisions also responded to the continuing trend of declining natural gas production. However, the utility industry maintained strong opposition to the off-gas provisions on the grounds that (1) the replacement of large portions of the generating capacity of natural gas-dependent utilities was beyond their financial capability, (2) the industry's plans already called for replacement of natural gas with other fuels on an orderly basis, and (3) implementation of the off-gas provisions would result increased dependence on imported oil. Our survey of this area featured a questionnaire.

56188 Modeling natural gas regulatory proposals using the Project Independence evaluation system. Murphy, F.H.; Sanders, R.C.; Shaw, S.H.; Thrasher, R.L. (US DOE, Washington, DC, USA). *Operations Research;* **29**: No. 5, 876-902(Sep-Oct 1981).

During the 1978 debates on the Natural Gas Pricing Act, Senator Henry M. Jackson of Washington, then Chairman of the Committee on Energy and Natural Resources, requested an analysis of the impact of the proposed legislation. A generic methodology was developed to represent alternative (average cost) regulatory proposals within the (marginal cost) framework of an economic equilibrium using the collection of models then known as the Project Independence Evaluation System. The results precipitated a controversy over the letter and intent of the competing legislative proposals. 7 refs.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 56119

56189 **(NP—2750466) Report on choice of pressure-level in distribution networks.** (Dansk Gasteknisk Forening, Hellerup). 1981. 28p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750466.

Presented at the annual meeting 1981.

As Denmark is on its way to build up a natural gas distribution network of about 10-15 000 km, it seems reasonable to utilize the experience of other large gas-consuming countries in this field. Choice of gas pressure in the distribution pipelines stands between 4 bar, 0,1 bar and 23 mbar. The particular systems are chosen on the basis of following regulations: the gas-using burners have to be supplied with gas pressure 20 mbar for good combustion, the highest pressure in a residential building must not exceed 100 mbar and polyethylene tubing can be used only up to 4 bar. 4 bars is the prefered gas pressure in 10 of 13 countries investigated.

56190 **(PB—82-180654) Effects of loads on the structural and fracture behavior of polyolefin gas piping. Topical report Jan 75-Jun 80.** Uralil, F.S.; Lee, C.S.; Markham, R.L.; Epstein, M.M. (Battelle Columbus Labs., OH (USA)). Dec 1981. 158p. NTIS, PC A08/MF A01.

Static and fatigue loading were used to simulate the external mechanical loads on polyolefin socket and butt fusion joints. Static loading modes include axial loading, constant deflection in bending, constant moment in bending, and point loading. Early failures are obtained with materials known to perform poorly in the field. As expected the rotary fatigue test yielded earlier failures than static tests although the method needs refinement. Tests for measuring specific fracture energy, stress intensification, and fracture toughness parameter were developed, and these properties were measured on a variety of polyolefin materials. It is shown that resistance to crack initiation and propagation are quite variable among polyolefin piping materials and for polyethylenes correlates for the most part with independent measurements of environmental stress crack resistance. Studies of fracture surfaces suggest that morphological details are a function of test conditions such as crack speed, temperature, etc. Linear elastic finite element analysis has been used to study the distribution of stress and crack extension in a socket joint configuration subjected to internal pressure. Computer predicted and laboratory generated data are compared and found to be in good agreement.

0340 Combustion

REFER ALSO TO CITATION(S) 56057

56191 **(CFD—82/2) Application of ESCIMO to the turbulent hydrogen-air diffusion flame.** Spalding, D.B.; Sun, R.L.T. (Imperial Coll. of Science and Technology, London (UK)). Jan 1982. 37p. (CONF-820801—). NTIS, PC A03/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

A simplified version of the ESCIMO program is applied to the hydrogen-air diffusion flame and is compared with experimental data. The reaction is assumed to be laminar-diffusion controlled within the fold. Fold properties depend upon age alone, at a given point in the flame. Fold properties at birth can be deduced by tracing upstream along a line of constant mean fuel-air ratio. Fold creation rate is proportional to entrainment rate, distributed in arbitrary ways across the jet. Fold size at birth is proportional to local jet width and the fold stretching rate is proportional to the average velocity gradient in the mean flow along the postulated trajectory. Comparisons with the experimental data show that: the agreement in respect of hydrodynamic features is good suitable choice of input parameters permits the experimental data for unmixedness to be fitted fairly well and the conceptual content of ESCIMO must be enlarged in order to allow for intermittency effects. (ESA)

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 56195

0402 Site Geology And Hydrology

56192 **Porphyrins in black trona water.** Smith, E.B.; Branthaver, J.F.; Heppner, R.A. (US DOE, Laramie, Wyo). *Organic Geochemistry;* **2**: No. 3-4, 141-152(Oct 1980).

Metalloprophyrins have been found in black trona water, a solution of sodium salts of organic acids occurring naturally in the Green River Formation of Wyoming. The porphyrins consist largely of nickel deoxophylloerythrin, a C-33 acid, and two lower methylene homologues, C-32 and C-31 acids, and possibly structural isomers of these. The C-32 acid is noticeably more abundant than either the C-33 or C-31 acids. Minor amounts of nickel etioporphyrins also are present. These porphyrins are believed to have been derived from the chlorophyll a synthesized by algae that inhabited Eocene Lake Gositute. The transformations to porphyrins occurred under the influence of high pH, a reducing environment, and geological time. Refs.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 56195

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 56005

56193 **(AD-A—111559/1) Development of superior denitrogenation and isomerization catalysts for processing crude oil derived from shale. Part II. Final report.** Katzer, J.R.; Kwart, H.; Stiles, A.B. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 1 Nov 1981. 12p. NTIS, PC A02/MF A01.

A number of facts have been observed during the course of the study and these have led to further tests or catalyst preparations, some of which have been completed, but many are in obeyance awaiting funding. The support is an extremely critical factor influencing the catalyst performance profoundly. Not only is the composition of the support critical but the method of preparation is equally critical. The hydrogenation characteristics of the catalyst are critical, and the ratio of Mo03 to hydrogenation metal also seems to be influenced by the support (possibly acidity or reactivity to form a solid-state reaction product between the composite support and the hydrogenation metal). The sulfiding of the catalyst prior to and during use is influenced by the support composition and hydrogenation metal. New presulfiding techniques probably will be required. HDN rates as high as three times that of a standard commercial catalyst (3.5% Ni, 18% Mo03, 78% gamma alumina) was achieved for alaphatic amines, but this was not followed by similar improvement in shale oil.

56194 **(PB—82-176256) Stress distribution and pillar design in oil shale retorts. Report of investigations.** Peng, S.S.; Thill, R.E. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). Jan 1982. 39p. (BM-RI—8597). NTIS, PC A03/MF A01.

The design of retort interchamber pillars is important in determining surface stability over in situ retort mines and to the health and safety of miners, particularly with respect to possible escape of heat and toxic gases from retort chambers. Stress distribution in retort interchamber pillars, roof, and floor was examined with the aid of linear, finite-element analysis using data from experimentally determined mechanical properties. Properties determined included elastic moduli, strength, and creep constants in laboratory tests on core covering a 100-foot depth interval in the oil shale from the Piceance Basin in Colorado. The most critical stress concentration was found in the rib side of the interchamber pillar at a height above the floor line of 1.25 times the width. Guidelines for pillar design that consider pillar strength, creep, and retorting temperature effects are proposed.

56195 **Research needs for shale-oil recovery.** Penner, S.S.; Bergen, W.S.; Clardy, J.; Hopkins, J.M.; Kelley, A.E.; Lessard, R.R.; Lewis, A.E.; Oblad, A.G.; Ross, J.; Sieg, R.P.; Thomas, J.R.; Weiss, M.A.; Weisz, P.B. (Univ of Calif, San Diego). *Energy (Oxford);* 6: No. 12, 1363-1404(Dec 1981).

The paper summarizes the results of a detailed evaluation of technologies for shale-oil recovery. This evaluation considers process development in aboveground retorting, fundamental research in aboveground retorting, research related to in situ processes, mining procedures development, development of improved instrumentation, environmental studies, water supplies, experimental refining of shale-derived oils for fuel, research to define potential utility of Eastern (U.S.) shale-oil recovery, procedures for costing shale oils pending first generation plants. Although members of the Fossil Energy Research Working Group (FERWG) have not arrived at an agreed upon priority ordering for research recommendations, fundamental research relating to surface recovery of oil shale, problems associated with spent shale disposal, and environmental studies are viewed as priority items for which augmented federal funding is well justified at the present time. Most of the FERWG members consider programs dealing with (a) improved resource assessments, (b) collection of needed environmental data, and (c) the development of processing technologies suitable for oil recovery from Eastern shales as appropriate for near-term federal support. A minority group within FERWG views RandD recommendations on Eastern shales as premature and unjustified. 18 refs.

56196 **BX in situ oil shale project.** Dougan, P.M.; Dockter, L. (Equity Oil Co, Salt Lake City, Utah). *Oil Shale Symposium Proceedings;* 118-127(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

The BX In Situ Oil Shale Project, jointly sponsored by Equity Oil Company and the U.S. Department of Energy, has been in operation continuously since September 18, 1979. Between that time and February 28, 1981, 625,300 barrels (99,400 m/sup 3/) of water as steam have been injected into eight Project injection wells at an average wellhead temperature of 605 /degree/F. (318 / degree/C.) and an average wellhead pressure of 1,314 psig (9,053 kPa). During the same period, 524,500 barrels (83,400 m/sup 3/) of fluid have been produced from five Project production wells. Steam injection has resulted in heating of the "leached zone " of the Parachute Creek Member of the Green River formation and this in turn has resulted in the in situ retorting of a portion of the oil shale of the "leached zone " and the recovery of a measurable amount of oil resulting from this retorting. 4 refs.

56197 **Economics of shale oil production by radio frequency heating.** Mallon, R.G. (Lawrence Livermore Lab, Calif). *Oil Shale Symposium Proceedings;* 128-137(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

A conceptual facility for the production of shale oil by radio frequency (RF) heating has been designed to evaluate the economic feasibility of this technique. In the proposed procedure, the shale is processed in situ without being rubbled or explosively fractured. Metal electrodes inserted in a set of vertical drill holes are energized by a group of RF oscillators. The holes bound a block of shale that is to be retorted. The electric field is developed in such a way that heating within the block is almost uniform, and heating outside the block is very low. Retorting of the shale results in a pressure buildup of the hydrocarbon fluids. The oil and gas move horizontally (parallel to bedding planes), then down the electrode holes to a collection manifold. The facility schedule is planned so that off-peak electric power from existing generating stations can be used to operate the oscillators. Thus, the cost of power and the capital requirements for the facility are held to a minimum. Oil production costs and capital requirements indicate that the proposed procedure is economically attractive. The two principal costs are purchase of electric power, and mining operations. 14 refs.

56198 **Steam cracking of shale oil liquids.** Tyler, A.L.; Bullen, E.A.; Jacobs, H.R. (Univ of Utah, Salt Lake City). *Oil Shale Symposium Proceedings;* 212-219(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

Shale oil liquids produced by steam pyrolysis of oil shales from Anvil Points and from the leached zone of the Parachute Creek member of the Green River Formation were cracked in the superheated steam in a one-liter autoclave. Steam pressures to 100 atm and temperatures to 454 /degree/C were employed. Gas samples were withdrawn and analyzed by gas chromotography and liquid samples were analyzed by GC-MS, C/sup 13/ NMR, and elemental analyses for carbon, hydrogen, nitrogen, and sulfur and oxygen. Sulfur content was reduced 98.7% and nitrogen content was reduced 35% in the cracked liquids. Pour points were reduced from 10/degree/C - 32/degree/C (50 /degree/F-90 /degree/F) for the starting material to less than -18/degree/C (O/degree/F.) Most of the unsaturated hydrocarbons were hydrogenated during cracking and the C/H ratio dropped from 7 after steam pyrolysis to 6.5 after cracking. 8 refs.

56199 **Parametric analysis of in situ retorting options for NOSR 1.** Sareen, S.S.; Bidlack, D.L. (TRW, McLean, Va). *Oil Shale Symposium Proceedings;* 257-269(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

Because vertical MIS (Modified In Situ) technology is still in a developmental stage, technical parameters that will define commerical operations are still being evaluated in field operations. So as not to bias the results against the use of an MIS concept on NOSR 1, due to lack of field data and poor assumptions, a parametric analysis was underaken which would evaluate this technology for the following variables; oil yield, retort configuration, cost, and compatibility with the NOSR 1 resource. Two retorting scenarios were considered: MIS retorting only and MIS/surface retorting combinations. Capital and operating costs have been estimated and selling price of oil calculated. Ranges of oil yield, shale grade, and surface in situ retort mix have been identified for economic operation. 6 refs.

56200 **Heat and mass transfer in porous media.** Cook, T.L.; Harlow, F.H.; Travis, B.J.; Bartel, T.J.; Tyner, C.E. (Los Alamos Natl Lab, NM). *Oil Shale Symposium Proceedings;* 282-288(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

Field test data on the OOSI MR3 experiments are used as a basis for exhibiting the computational capabilities of the WAFE computer code, which is a generalized tool for the analysis of heat and mass transfer in multi-dimensional domains of porous geothermal materials.

56201 **Organic and inorganic analysis of constituents in water produced during in situ combustion experiments for the recovery of tar sands.** Barbour, F.A.; Guffey, F.D. (US DOE, Laramie, WY). *American Society for Testing and Materials, Special Technical Publication;* No. 720, 38-55(1980). (CONF-790663—).

From Symposium on analysis of waters associated with alternate fuel production; Pittsburgh, PA, USA (4 Jun 1979).

The characterization of waters produced during in situ combustion of a tar sand deposit near Vernal, Utah, is presented. The water samples were collected during two different field experiments. Analysis of the inorganic constituents by standard methods indicated that ammonium, sulfate, and chloride were the predominant ions. Fractions of the organic material, defined as acid and base extracts, were obtained by liquid-liquid extraction using ethyl ether. Gravimetrically, the acid extracts comprised more than 70 percent of the extractable organic material. Identification of the components in the acid extracts was accomplished by using combined gas chromatography-mass spectroscopy (GC-MS) after methylation with diazomethane. The base extracts were found to be more complex and could not be studied directly with GC-MS. Of the major organic compounds identified, carboxylic acids, particularly acetic acid, were found to be the most abundant. Phenols, lactones, and pyridines were also identified. 6 refs.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 56206

56202 **(PB—82-155193) Certification of selected polynuclear aromatic hydrocarbons in standard reference material 1580, 'Organics in Shale Oil'. Final report.** May, W.E.; Brown-Thomas, J.M.; Hilpert, L.R.; Wise, S.A. (National Bureau of Standards, Washington, DC (USA)). 1981. 16p. Proceedings of Polynuclear Aromatic Hydrocarbons: International Symposium Chemical Analysis and Biological Fate (5th), Held at Columbus, Ohio on October 27-29, 1980, p1-16 1981.

Two independent analytical methods were developed and used to certify the concentrations of five polynuclear aromatic hydrocarbons (PAH) in a shale oil sample (SRM 1580). In the sequential high-performance liquid chromatographic method, PAH are isolated from the matrix by chromatography on an aminosilane column. The individual analyte species were separated, identified, and quantified by chromatography on an octadecylsilane column with spectrofluorimetric detection. Dilution of the sample in methylene chloride was the only sample preparation step necessary prior to analysis by gas chromatography/mass spectrometry (GC/MS). The GC/MS determinations were performed using selected ion monitoring (SIM) and a standard addition technique for quantification. The polynuclear aromatic hydrocarbons of interest were separated on a 30 m SE-52 wall coated open tubular column interfaced to a quadrupole mass spectrometer through a 25 cm length of Pt/Ir tubing (0.15 mm i.d.). Excellent agreement was observed between the data obtained from these methods.

56203 **Predicted electrical conductivity in oil shale during retorting.** Duba, A. (Lawrence Livermore Natl Lab, CA). pp 1023-1027 of Digest of international geoscience and remote sensing symposium (IGARSS '81). Volume 2. New York, NY; IEEE (1981).

From International geoscience and remote sensing symposium; Washington, DC, USA (8 Jun 1981).

R.L. Braun (1979) has published the results of a mathematical model for simulating in-situ retorting of rubblized beds of oil shale. This model, based on thermodynamics and kinetics of chemical reactions and physical processes involved in both inert gas and combustion retorting, estimates the temperature profile in an in-situ retort. This paper reports calculations of the electrical conductivity for two temperature profiles in a retort using Braun's model and literature data for Kukersite, an Estonian oil shale. These calculations indicate that electromagnetic techniques might be exploited to provide a remote diagnostic technique for the location of high temperature volumes or regions during oil shale retorting. 7 refs.

56204 **Dynamic fracture and fragmentation of oil shale: application of a numerical model to a blast design.** Boade, R.R.; Kipp, M.E.; Grady, D.E. (Sandia Natl Lab, Albuquerque, NM). *Oil Shale Symposium Proceedings;* 31-52(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

A variety of experiments have revealed that the failure phenomenon in oil shale is highly strain-rate dependent. Data from the experiments have provided a base for a computational model for dynamic fracture and fragmentation. This model has been incorporated into a two-dimensional wavecode called TOODY and is now ready for rudimentary assessments of practical blasting schemes. Such an application has recently been undertaken for a modified in situ blasting concept which uses an array of vertically oriented explosive charges configured and sequentially detonated in decks. The charges are in boreholes drilled from a horizontal surface (floor or back) of a mined cavity. Within each deck the charges are in a square pattern. From deck-to-deck, the positions of the square patterns alternate so charges in one deck are centered with respect to charges in an adjacent deck. 27 refs.

56205 **/sup 13/C NMR studies of oil shale evaluation and processing.** Miknis, F.P.; Maciel, G.E. (DOE, Laramie, Wyo). *Oil Shale Symposium Proceedings;* 270-281(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

The solid state NMR techniques of cross polarization with magic angle spinning have been employed to characterize the organic carbon distribution in raw, partially and fully retorted oil shales. A high degree of correlation was obtained between the fraction of aliphatic carbon in an oil shale and the genetic potential of oil shales from various worldwide deposits. The correlation was found to be independent of geologic factors such as geologic age or environment of deposition of the oil shales. NMR measurements of a Colorado oil shale heated to various retorting temperatures for a fixed time period show a depletion of the aliphatic carbon fraction relative to the aromatic carbon fraction. This depletion becomes more pronounced with increasing temperature. NMR measurements of the carbon distribution of several different types of oil shales show that residual carbon in retorted oil shales is almost exclusively aromatic. 39 refs.

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 56154, 56208

56206 **What's wrong with using shale oil as a source for alternate fuels.** Lavy, M.W.; Eckard, D.W. (Cooper Energy Serv, Springfield, OH). *American Society of Mechanical Engineers, [Paper];* No. 82-DGP-15, vp(Mar 1982).

The primary objective of this paper was to identify problems associated with running a large stationary diesel engine on alternate fuels. Engine performance and operational characteristics of the alternate fuels are compared with No. 2 diesel fuel. The two fuels which have been evaluated to date are: Distillate shale oil (DFM); DFM blended with No. 5 residual oil.

0407 Health And Safety

REFER ALSO TO CITATION(S) 56056

56207 **(LA-UR—82-1284) Industrial hygiene aspects of underground oil shale mining.** Hargis, K.M.; Jackson, J.O. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 37p. (CONF-820458—1). NTIS, PC A03/MF A01. Order Number DE82015743.

From Conference on health issues related to metal and nonmetallic mining; Park City, UT, USA (7 Apr 1982).

Portions of document are illegible.

Health hazards associated with underground oil shale mining are summarized in this report. Commercial oil shale mining will be conducted on a very large scale. Conventional mining techniques of drilling, blasting, mucking, loading, scaling, and roof bolting will be employed. Room-and-pillar mining will be utilized in most mines, but mining in support of MIS retorting may also be conducted. Potential health hazards to miners may include exposure to oil shale dusts, diesel exhaust, blasting products, gases released from the oil shale or mine water, noise and vibration, and poor environmental conditions. Mining in support of MIS retorting may in addition include potential exposure to oil shale retort offgases and retort liquid products. Based upon the very limited industrial hygiene surveys and sampling in experimental oil shale mines, it does not appear that oil shale mining will result in special or unique health hazards. Further animal toxicity testing data could result in reassessment if findings are unusual. Sufficient information is available to indicate that controls for dust will be required in most mining activities, ventilation will be necessary to carry away gases and vapors from blasting and diesel equipment, and a combination of engineering controls and personal protection will likely be required for control of noise. Recommendations for future research are included.

0408 Marketing And Economics

56208 **Market analysis of shale oil co-products.** Kuuskraa, V.A.; Hammershaimb, E.C.; Broz, J.S.; Higgins, E.G. (Lewin and Assoc, Washington, DC). *Oil Shale Symposium Proceedings;* 197-211(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

This study estimates that the projected markets for soda ash and alumina could potentially support a shale oil industry of 500,000 barrels per day by the year 2000. Thus, co-product minerals could make an important economic contribution to a shale oil industry by improving the economics of the total project. This could potentially extend the oil shale resource that is economically recoverable and lower the minimum economic plant size. 3 refs.

56209 **Oil shale venture analysis model.** Sheerin, J. (US DOE). pp 682-691 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

Existing engineering data, financing parameters, and specifications associated with federal subsidy of oil shale and have been utilized in simulating project-level economic performance. The venture analysis model used solves for the rate of discount required to equate projected costs and revenues. 10 refs.

56210 **Oil shale technologies ready now for commercialization.** Zukov, S.H.; Petzrick, P.A. (DOE, Washington, DC). pp 692-701 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

This paper describes the use of oil shale as an alternative to petroleum derived fuels. Federal government participation and socioeconomic impact is described.

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 56201, 56222, 56223

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 56058, 56195, 56201, 58216

56211 (DOE/EIS—0068-F) **Development policy options for the Naval Oil Shale Reserves in Colorado. Final Programmatic Environmental Impact Statement.** (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC. Office of Naval Petroleum and Oil Shale Reserves). Aug 1982. 546p. NTIS, PC A23/MF A01. Order Number DE82020551.

Portions of document are illegible.

This programmatic statement examines five development policy options and eight liquid fuel alternatives, one of which is oil shale on NOSR 1. The other seven are oil shale on other lands (Colony), conservation, enhanced oil recovery (EOR), offshore oil production, coal liquefaction (SRC II), biomass/alcohol and no action at this time. The document compares the environmental impacts of two levels of production from NOSR 1 (50,000 BPD and 200,000 BPD) to those of an equivalent production (or conservation) from the other liquid fuel sources. The socioeconomic and financial impacts of the five development policy options, which range from zero to 100% government participation, are also evaluated. Based upon an evaluation made during the summer of 1981, the Secretary of Energy determined that the development of NOSR 1 was not warranted at that time. That no action decision is identified as the preferred alternative in this EIS. The development question is being periodically re-examined, however, and should the decision be made to develop NOSR 1, a site- (and process-) specific EIS would precede any development activity by DOE and would discuss environmental impacts, including cumulative impacts, in detail.

56212 **(DOE/EV/04018—6) Revegetation studies on oil shale related disturbances in Colorado.** Redente, E.F.; Cook, C.W. (Colorado State Univ., Fort Collins (USA). Dept. of Range Science). Jun 1982. Contract AC02-76EV04018. 90p. NTIS, PC A05/MF A01. Order Number DE82020140.

Portions of document are illegible.

An interdisciplinary research project was initiated in 1976 to provide both basic and applied information that would aid in the reestablishment of natural functioning ecosystems on land disturbances associated with energy development. The approach included field, laboratory, and greenhouse experiments designed to provide both structural and functional information about disturbed ecological systems in the semiarid west. This report presents results from the sixth year of the study. Separate abstracts have been prepared for each of the 4 studies reported for inclusion in the Energy Data Base. (DMC)

56213 (DOE/EV/04018—6, pp 1-25) **Effects of plant species, soil material, and cultural practices upon plant establishment and succession.** Redente, E.F.; Doerr, T.B.; Grygiel, C.E.; Allerdings, E.; Stark, J.M.; Biondini, M.E. Jun 1982. NTIS, PC A05/MF A01.

In Revegetation studies on oil shale related disturbances in Colorado.

This subproject has several interrelated objectives directed toward the establishment of diverse, functional, and self-sustaining ecosystems with a minimum input of amendments. The results from this subproject will ultimately serve to provide procedures for establishing effective plant communities on lands disturbed by oil shale mining and retorting processes. Various plant species mixtures (native and introduced), planting techniques, fertilization treatments, mulch, and irrigation are being tested on disturbed soils, retorted oil shale, and soil over retorted shale material. The specific objectives of the research include: (1) determining proper seeding practices of potentially usable mixtures of plant species and their relationship to cultural practices such as fertilization, irrigation, and mulching, (2) determining the rate and direction of plant succession on disturbed topsoil, subsoil, overburden, retorted shale, and retorted shale overlain by soil as influenced by natural invasion, species mixtures, and cultural practices, and (3) determining proper management procedures for long-term stabilization and reclamation of retorted shale materials.

56214 (DOE/EV/04018—6, pp 27-44) **Soil microorganisms and management of retorted shale reclamation.** Klein, D.A.; Sorenson, D.L.; Metzger, W. (Colorado State Univ., Fort Collins). Jun 1982. NTIS, PC A05/MF A01.

In Revegetation studies on oil shale related disturbances in Colorado.

The effects of soil disturbance and retorted oil shale on the development of soil microbial processes have been monitored in relation to seeding mixture, fertilization, irrigation, and seeding variables. Specific objectives include the following: (1) to evaluate microbial responses during reestablishment of plant communities on disturbed and revegetated soils using plots established at the Intensive Study Site; (2) to study the effects of soil storage and disturbance on microbiological populations and on microorganism-related nutrient cycling processes; (3) to determine the effects of retorted shale on the microbiological characteristics and activities in surface soils placed over the retorted material as it relates to revegetation potential; and (4) to study belowground responses using reclamation plots in western Colorado which have been monitored for plant development on retorted shale materials and which were constructed in 1971 to 1974.

56215 (DOE/EV/04018—6, pp 45-56) **Importance of mycorrhizal fungi in revegetating disturbed soils and retorted shale.** Reeves, F.B. Jr.; Reinsvold, R.; Saboloni, J.; Park, A. (Colorado State Univ., Fort Collins). Jun 1982. NTIS, PC A05/MF A01.

In Revegetation studies on oil shale related disturbances in Colorado.

From previous studies we have shown that most of the dominant plants in stable ecosystems in the Piceance Basin of Colorado and in the surrounding regions of the semiarid west are mycorrhizal, that is, these plants have symbiotic vesicular-arbuscular mycorrhizal (VAM) fungi growing on their root systems. When soil is severely disturbed or stored for long periods of time, either vegetation may be lacking or the invading plant species are typically nonmycorrhizal weedy species. Mycorrhizal fungi require suitable hosts to provide nutrients for their long-term survival; thus, the absence of suitable vegetation leads to significantly reduced populations of these beneficial fungi. When VAM fungi are eliminated by death, dilution of the soil with effectively sterile soil (deep soils), or sterilization (processed oil shale), those plant species that are mycorrhiza-dependent will not generally survive under natural conditions of low nutrient and moisture availability. To understand the succession of plants that depend on these fungi and to optimize reclamation procedures on severely disturbed soils, information on the population ecology of these beneficial fungi is essential. The main goal of this subproject was to develop an understanding of how these fungi can be maintained or reestablished in disturbed, stored, or processed (e.g., oil shale) soils.

56216 (DOE/EV/04018—6, pp 67-85) **Nitrogen supply by legumes and other fertility sources for disturbed lands.** Sabey, B.R.; Cuany, R.L.; Oleski, N.; Barry, J. (Colorado State Univ., Fort Collins). Jun 1982. NTIS, PC A05/MF A01.

In Revegetation studies on oil shale related disturbances in Colorado.

The overall objective of this subproject is to determine the long-term fertility requirements and methods of meeting these requirements on N- and P-deficient soil materials used as plant growth medium for reclamation of land disturbed by oil shale development in northwestern Colorado. (A) Examine contribution and potential of the legume-Rhozobium nitrogen-fixing system: (1) Determine nitrogen status in the soil, the legume top growth, and the top growth of associated grasses, as influenced by species, soil medium, and initial fertilizer application. (2) Determine by acetylene-reduction assay the relative rates of nitrogen-fixation ability of selected legumes in the same plot measured for 1. (3) Analyze the growth, seed setting ability, and seasonal N-fixation ability of several species of native and introduced legumes, as to their suitability in rehabilitation. (4) Compare nodule formation on legume roots growing in surface disturbed topsoil with those growing in or near subsurface retorted oil shale, wherever such plots can be destructively sampled. (B) Determine how much nitrogen has been lost from the zone of incorporation and moved into the retorted shale below the topsoil due to leaching.

56217 (DOE/EV/04018—6, pp 57-65) **Ecogenetic variability in native shrubs related to the reestablishment of vegetation on disturbed arid shrublands.** Ward, R.T.; Slauson, W.L.; Welden, C.W. (Colorado State Univ., Fort Collins). Jun 1982. NTIS, PC A05/MF A01.

In Revegetation studies on oil shale related disturbances in Colorado.

The objectives of this program are: to evaluate the natural variation within species (especially shrubs) native to the Piceance Basin, Colorado; to make recommendations regarding source materials which can be expected to give long-term, natural success on particular sites; and to evaluate the responses of shrub species already growing in the edaphic environment containing retorted shales. Ecotypic differentiation is not strongly evidenced for the populations studied. Ecotypic differentiation with respect to competitive ability, moisture, and short growing season stress has taken place. Shrubs grown on retorted shale are smaller and slower growing. Only those species characteristic of the specific site have been successful. (DMC)

56218 **(PB—82-156738) Water assessment of Cathedral Bluffs shale oil demonstration project, White River basin - Colorado.** (International Engineering Co., Inc., Denver, CO (USA)). Sep 1981. 85p. NTIS, PC A05/MF A01.

This water assessment was undertaken by the U.S. Water Resources Council (WRC) under authority of the Federal Non-Nuclear Energy Research and Development Act of 1974, as amended. WRC gives an assessment for the Cathedral Bluffs Shale Oil Demonstration Project, located within the White River Basin, Colorado. The objectives of the study were to identify and document: Water requirements for the project; present and future water supply availability; and water resources impacts.

56219 **(PB—82-159831) Water assessment report on Cathedral Bluffs Shale Oil Demonstration Project, White River Basin - Colorado.** (International Engineering Co., Inc., Denver, CO (USA)). Sep 1981. 85p. NTIS, PC A05/MF A01.

This water assessment was undertaken by the U.S. Water Resources Council under authority of the Federal Non-Nuclear Energy Research and Development Act of 1974, as amended. The Act provides that an assessment of water requirements and water supply be made for any non-nuclear energy technology. That assessment concluded that there was an overall supply of ground and surface water in the Upper Colorado River Basin sufficient to accommodate a synfuels production level of nearly 3-million barrels oil equivalent in the White River Basin in Colorado and Utah. Consequently, in order to provide dependable water supplies for synfuels development and other water needs, major reservoirs and other water supply facilities would be required.

56220 **Hydrogeologic consequences of the modified in-situ retorting process, Piceance Creek Basin, Colorado.** Mehran, M.; Narasimhan, T.N.; Fox, J.P. (Univ of Calif, Berkeley). *Oil Shale Symposium Proceedings;* 388-400(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

The study has been aimed at studying the possible alteration of the groundwater regime in and around the C-a and the C-b tracts due to the proposed MIS strategies. The approach has been one of scenario analysis and parametric studies, using a numerical model. The results suggest that mine-inflow rates will gradually increase with time and that the phreatic surface will be drawn down significantly over several sqaure kilometers around the C-a and C-b tracts. These drawdowns could have profound effects on the shallow groundwater and surface water supplies. The studies indicate that in an expanding mine, the inflows are likely to be concentrated in the neighborhood of newly excavated regions where hydraulic gradients will be highest. It has been estimated that inflow into individual retorts may vary from 0.15 *10/sup -3/ to 0.95 *10/sup -3/ m/sup 3//sec. 14 refs.

56221 **Environmental research at the Laramie Energy Techonology Center.** Sheesley, D.C.; McTernan, W.F.; Westhoff, J.D.; Poulson, R.E. (US DOE, Laramie, Wyo). *Oil Shale Symposium Proceedings;* 426-433(1981). (CONF-810456—).

From 14. oil shale symposium; Golden, CO, USA (22 Apr 1981).

Since the founding legislation in 1944, the Laramie Energy Technology Center (LETC) and the associated Anvil Points Oil Shale Facility have been affiliated with three different agencies: the Bureau of Mines, the Energy Research and Development Administration and currently the Department of Energy (DOE). The activities at the Center have ranged from nearly academic pursuits to the management of Modular demonstration (precommercialization) projects in processing techonolgy through Government/Industry Cooperatives. Current program plans are in terms of long range, high risk research at laboratory, bench and pilot scale to examine concepts. Current research programs at LETC in mitigation and monitoring of environmental impacts for air, water and land/solid waste are presented. 16 refs.

56222 **Elemental composition of simulated in situ oil shale retort water.** Fox, J.P. (Univ. of California, Berkeley). *American Society for Testing and Materials, Special Technical Publication;* No. 720, 101-128(1980). (CONF-790663—).

From Symposium on analysis of waters associated with alternate fuel production; Pittsburgh, PA, USA (4 Jun 1979).

The abundances are given of 47 elements in 23 unfiltered retort waters from three simulated in situ retorts and of 17 elements in the dissolved and particulate fraction of 11 of these waters. For most of the unfiltered waters, the carbon, hydrogen, nitrogen, and sulfur occur at concentrations greater than 0.1 percent; aluminum, arsenic, calcium, iron, potassium, sodium, nickel, and chlorine occur at concentrations greater than 1 ppm and less than 0.1 percent; and all other measured elements occur at concentration of less than 1 ppm. The particulate fraction in these waters ranges from 203 to 2984 mg/litre, and, in most waters, iron, nickel, potassium, and calcium occur at concentrations that are greater than 0.1 mg/ltre. (Carbon, hydrogen, nitrogen, and sulfur were not measured in the particulates). All other measured elements (titanium, vanadium, chromium, manganese, gallium, arsenic, selenium, bromine, rubidium, strontium, yttrium, mercury, and lead) typically occur at concentrations of less than 0.05 mg/litre in the particulates. 21 refs.

56223 **Paraho waters - characteristics and analysis of major constituents.** Wildeman, T.R.; Hoeffner, S.L. (Colorado School of Mines, Golden). *American Society for Testing and Materials, Special Technical Publication;* No. 720, 129-141(1980). (CONF-790663—).

From Symposium on analysis of waters associated with alternate fuel production; Pittsburgh, PA, USA (4 Jun 1979).

Eight types of water samples were obtained from the Paraho above-ground oil shale retort. These samples include three different sampling sites on the retort, two from different sites in the oil storage facilities, and three samples from different sites at the evaporation pond. Analyses of the pH, oxidizing capacity as Eh, conductivity, alkalinity, ammonia, total sulfur, and thiosulfate are described. Also, the results of these analyses are presented for water samples prepared and stored by different methods. Special methods were developed for the conductivity analysis. The results for the total sulfur analysis are doubtful; a number of problems are still to be solved for this analysis. The water parameters that appear to be most vulnerable to handling and storage are the pH and conductivity. 16 refs.

05 NUCLEAR FUELS

0501 Reserves

56224 **Petrography of the uranium-bearing minerals of the Liberty Hill pluton, South Carolina: phase assemblages and migration of uranium in granitoid rocks.** Speer, J.A.; Solberg, T.N.; Becker, S.W. (Va Polytech Inst and State Univ, Blacksburg, USA). *Economic Geology and the Bulletin of the Society of Economic Geologists;* **76**: No. 8, 2162-2175(Dec 1981).

Optical petrography, fission track U mapping, and electron microprobe analysis of granitoid rocks from the Liberty Hill pluton, South Carolina, show a nonuniform distribution of U in the rocks. In order of abundance, U occurs: in accessory minerals, with U concentrations decreasing in the order: uraninite, coffinite, uranoan thorite, zircon, monazite, titanite, allanite, apatite, zeolites; on altered sulfaces of Fe/sup +2/- and S-bearing minerals; at microcracks filled with carbonate, zeolite, and Fe-Mn oxyhydroxide minerals; on clay minerals of altered feldspars; and in major minerals as a widely dispersed minor component. Thorium has been identified in the accessory minerals thorite, thoroan uraninite, coffinite, allanite, and monazite. Uranium and Th distribution is believed to be of magmatic origin within the major U-Th-Zr phase assemblage: uranoan thorite +zircon /plus or minus/ uraninite. The mechanisms of U retention are similar to those found in sedimentary U deposits. The U-Th-Pb isotope studies of the Liberty Hill pluton show that these mechanisms are effective in retaining the initial concentrations of U. Refs.

56225 **Domestic uranium industry and uranium imports.** Patterson, J.A. (US DOE, Washington, DC). pp 1-22 of Atomic Industry Forum, fuel cycle conference '81, 1981. Washington, DC; Atomic Industry Forum (1981).

From Fuel cycle conference; Los Angeles, CA, USA (15 Mar 1981).

Scope of DOE study is reviewed. The study covered three main topics which were basic to a review of the problem. The first covered the state of the domestic uranium producing industry, including a number of factors indicative of the viability of the industry, and the market outlook in the U.S. The second covered the foreign supply and demand situation. The third covered the experience and outlook in the use of foreign uranium in the United States. The author indicates own findings about the state of industry and the impacts of important uranium on the industry. It is reported that the U.S. has a substantial uranium resource base but only limited portions of those resources are economic at prices expected to prevail during the next several years. Exploration has been at high levels but has been declining substantially in the last two years. Production is at record levels and further expansions to capacity are underway. Nonetheless, production is expected to decrease in the near term.

56226 **US uranium resource base.** Chenoweth, W.L. (Dept. of Energy, Grand Junction, CO). pp 53-71 of Uranium resource technology, Seminar 3, 1980. Morse, J.G. (ed.). Golden, CO; Colorado School of Mines Press (1980).

From 3. uranium resource technology seminar; Golden, CO, USA (10 Mar 1980).

Uranium resources, as used by the US Department of Energy, consist of reserves and potential resources. Reserves are the firmest element of resources, comprising deposits that have been delineated by drilling or other direct sampling methods. Potential resources are divided into probable, possible and speculative classes. They represent, in declining order of reliability, the quantities of uranium believed to be present in deposits that are incompletely defined or undiscovered. The resources discussed in this paper are the result of the mid phase of the National Uranium Resource Evaluation. Potential resources are estimated and their predicted locations are described in some detail.

0502 Exploration

56227 **(GJBX—13-82) Uranium hydrogeochemical and stream-sediment reconnaissance of the Big Delta NTMS quadrangle, Alaska.** Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Feb 1982. Contract AC13-76GJ01664. 143p. NTIS (US Sales Only). Order Number DE82016203.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Big Delta NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56228 (GJBX—14-82) Uranium hydrogeochemical and stream-sediment reconnaissance of the Bettles NTMS quadrangle, Alaska. D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L.; Hardy, L.C. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Feb 1982. Contract AC13-76GJ01664. 111p. NTIS (US Sales Only). Order Number DE82016202.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Bettles NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56229 (GJBX—16-82) National Uranium Resource Evaluation: uranium hydrogeochemical and stream-sediment reconnaissance of the Wolf Point NTMS Quadrangle, Montana. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Jun 1982. Contract AC13-76GJ01664;W-7405-ENG-36. 135p. NTIS (US Sales Only). Order Number DE82020451.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Wolf Point NTMS quadrangle, Montana. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and ground-water samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56230 (GJBX—46-82) Uranium hydrogeochemical and stream-sediment reconnaissance of the Mt. Michelson NTMS quadrangle, Alaska. Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L.; Hardy, L.C.; D'Andrea, R.F. Jr. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Apr 1982. Contract AC13-76GJ01664. 77p. NTIS (US Sales Only). Order Number DE82016201.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Mt. Michelson NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56231 (GJBX—47-82) Uranium hydrogeochemical and stream-sediment reconnaissance of the Sumdum NTMS quadrangle, Alaska. Shettel, D.L. Jr.; Langfeldt, S.L.; Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Apr 1982. Contract AC13-76GJ01664. 14p. NTIS (US Sales Only). Order Number DE82016200.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Sumdum NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and lake-sediment samples. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56232 (GJBX—48-82) Uranium hydrogeochemical and stream-sediment reconnaissance of the Wainwright NTMS quadrangle, Alaska. Langfeldt, S.L.; Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Apr 1982. Contract AC13-76GJ01664. 50p. NTIS (US Sales Only). Order Number DE82016199.

Portions of document are illegible.

This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Wainwright NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56233 (GJBX—49(82)) Uranium hydrogeochemical and stream-sediment reconnaissance of the Chandler Lake NTMS quadrangle, Alaska. Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Mar 1982. Contract AC13-76GJ01664. 91p. NTIS (US Sales Only). Order Number DE82016198.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Chandler Lake NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56234 (GJBX—67-82) Uranium Resource Evaluation Project. Hydrochemical and stream-sediment reconnaissance basic data for Palestine, Alexandria, and Natchez Quadrangles, Texas; Louisiana; Mississippi. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 7 Jun 1982. Contract AC13-76GJ01664;W-7405-ENG-26. 81p. (K/UR—422). NTIS (US Sales Only). Order Number DE82020437.

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Data are compiled for hydrochemical and stream sediment reconnaissance of the Palestine, Alexandria and Natchez quadrangles in Texas, Louisiana and Mississippi.

56235 (GJBX—70-82) Uranium Resource Evaluation Project. Hydrochemical and stream-sediment reconnaissance basic data for Ardmore, McAlester, Little Rock, and Helena Quadrangles, Oklahoma; Arkansas; Mississippi. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 9 Jun 1982. Contract AC13-76GJ01664;W-7405-ENG-26. 61p. (K/UR—425). NTIS (US Sales Only). Order Number DE82020435.

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Data are compiled for hydrochemical and stream sediment reconnaisance of the following quadrangles: Ardmore, McAlester, Little Rock and Helena. These quadrangles are in Oklahoma, Arkansas and Mississippi.

56236 (GJBX—89(82)) Uranium hydrogeochemical and stream-sediment reconnaissance of the Demarcation Point NTMS quadrangle, Alaska. National Uranium Resource Evaluation. D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L.; Hardy, L.C. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Mar 1982. Contract AC13-76GJ01664;W-7405-ENG-36. 86p. Dep.

Portions of document are illegible.

This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Demarcation Point NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56237 (GJBX—90(82)) Uranium hydrogeochemical and stream-sediment reconnaissance of the Juneau NTMS quadrangle, Alaska. Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L.; Hardy, L.C.; D'Andrea, R.F. Jr. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Apr 1982. Contract AC13-76GJ01664. 60p. NTIS (US Sales Only). Order Number DE82016188.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Juneau NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56238 (GJBX—91(82)) Uranium hydrogeochemical and stream-sediment reconnaissance of the Point Hope NTMS quadrangle, Alaska. Shettel, D.L. Jr.; Langfeldt, S.L.; Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Apr 1982. Contract AC13-76GJ01664. 50p. NTIS (US Sales Only). Order Number DE82016187.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Point Hope NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appenidx A describes the sample media and summarizes the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into stream-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1;1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56239 (GJBX—92(82)) Uranium hydrogeochemical and stream-sediment reconnaissance of the Utukok River NTMS quadrangle, Alaska. Langfeldt, S.L.; Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Mar 1982. Contract AC13-76GJ01664. 91p. NTIS (US Sales Only). Order Number DE82016186.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Utukok River NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1;1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56240 (GJBX—93(82)) Uranium hydrogeochemical and stream-sediment reconnaissance of the Teshekpuk NTMS quadrangle, Alaska. Hardy, L.C.; D'Andrea, R.F. Jr.; Zinkl, R.J.; Shettel, D.L. Jr.; Langfeldt, S.L. (comps.). (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Apr 1982. Contract AC13-76GJ01664. 66p. NTIS (US Sales Only). Order Number DE82016185.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Teshekpuk NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendix A describes the sample media and summarizes the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56241 (GJBX—141-82) National Uranium Resource Evaluation: uranium hydrogeochemical and stream-sediment reconnaissance of the Shishmaref NTMS Quadrangle, Alaska. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Jul 1982. Contract AC13-76GJ01664;W-7405-ENG-36. 24p. D. Order Number DE82020189.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Shishmaref NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A through D describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment, lake-sediment, stream-water, and lake-water samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56242 (GJBX—142-82) National Uranium Resource Evaluation: uranium hydrogeochemical and stream-sediment reconnaissance of the Shungnak NTMS Quadrangle, Alaska. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Los Alamos National Lab., NM (USA)). Jul 1982. Contract AC13-76GJ01664;W-7405-ENG-36. 113p. NTIS (US Sales Only). Order Number DE82020726.

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This report presents results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Shungnak NTMS quadrangle, Alaska. In addition to this abbreviated data release, more complete data are available to the public in machine-readable form. These machine-readable data, as well as quarterly or semiannual program progress reports containing further information on the HSSR program in general, or on the Los Alamos National Laboratory (LANL) portion of the program in particular, are available from DOE's Technical Library at its Grand Junction Area Office. Presented in this data release are location data, field analyses, and laboratory analyses of several different sample media. For the sake of brevity, many field site observations have not been included in this volume; these data are, however, available on the magnetic tape. Appendices A and B describe the sample media and summarize the analytical results for each medium. The data have been subdivided by one of the Los Alamos National Laboratory sorting programs of Zinkl and others (1981a) into groups of stream-sediment and lake-sediment samples. For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements have been included in this report. Also included are maps showing results of multivariate statistical analyses. Information on the field and analytical procedures used by the Los Alamos National Laboratory during sample collection and analysis may be found in any HSSR data release prepared by the Laboratory and will not be included in this report.

56243 (PGJ/F—069-82) National Uranium Resource Evaluation: Laredo Quadrangle, Texas. Cherepon, A.J.; Stauber, A.J. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations). Aug 1982. Contract AC13-76GJ01664. 339p. NTIS PCE12/MF A01. Order Number DE82020157.

Includes 2 sheets of 24x reduction microfiche. Portions of document are illegible.

The Laredo Quadrangle, Texas, was evaluated to a depth of 1500 m to identify environments and delineate areas favorable for the occurrence of uranium deposits. The areas were delineated in accordance with criteria established by the National Uranium Resource Evaluation program sponsored by the US Department of Energy. Surface studies included investigations of uranium occurrences described in the literature, location of aerial radiometric anomalies, outcrop studies, and followup of hydrogeochemical and stream-sediment reconnaissance data. Subsurface evaluation of selected geologic units was accomplished by using electric and gamma-ray well logs to construct maps and cross sections. An environment favorable for Texas roll-type sandstone uranium deposits is identified in 62 areas in the Goliad, Oakville, Catahoula, Frio, and Whitsett Formations. The Midway Group; the Reklaw, Weches, Cook Mountain, Caddell, Wellborn, Manning, Vicksburg, and Anahuac Formations; the Chusa Member of the Catahoula Formation; the Fleming, Uvalde, Lissie, and Beaumont Formations; and river-terrace deposits and deposits of recent age are considered unfavorable. The Yegua, Sparta, Laredo, and Queen City Formations; the El Pico Clay; the Bigford and Carrizo Formations; the Wilcox Group; and the Escondido, Olmos, and San Miguel Formations were examined but not evaluated.

56244 (PGJ/F—070-82) National Uranium Resource Evaluation: Wells Quadrangle, Nevada, Idaho, and Utah. Proffitt, J.L.; Mayerson, D.L.; Parker, D.P.; Wolverson, N.; Antrim, D.; Berg, J.; Witzel, F. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations). Aug 1982. Contract AC13-76GJ01664. 168p. NTIS PCE07/MF A01. Order Number DE82020012.

Includes 3 sheets of 24x reduction microfiche. Portions of document are illegible.

The Wells 2° Quadrangle, Nevada, Idaho, and Utah, was evaluated using National Uranium Resource Evaluation criteria to delineate areas favorable for uranium deposits. Our investigation has resulted in the delineation of areas that contain Tertiary sedimentary rocks favorable for hydroallogenic deposits in the Mountain City area (Favorable Area A) and in the Oxley Peak area north of Wells (Favorable Area B). Environments considered to be unfavorable for uranium deposits include Tertiary felsic volcanic, felsic plutonic, intermediate to mafic volcanic, Paleozoic and Mesozoic sedimentary rocks, Precambrian rocks, and most Tertiary sedimentary rocks located outside the favorable areas. Present-day basins are unevaluated environments because of a paucity of adequate outcrop and subsurface data. However, the scarce data indicate that some characteristics favorable for uranium deposits are present in the Susie Creek-Tule Valley-Wild Horse basin, the Contact-Granite Range-Tijuana John stocks area, the Charleston Reservoir area, and the Wells-Marys River basin.

56245 (PGJ/F—077-82) National Uranium Resource Evaluation: Bozeman Quadrangle, Montana. Lange, I.M.; Fields, R.W.; Fountain, D.M.; Moore, J.N.; Qamar, A.I.; Silverman, A.J.; Thompson, G.R.; Chadwick, R.A.; Custer, S.G.; Smith, D.L. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations; Montana Univ., Missoula (USA). Dept. of Geology; Montana State Univ., Bozeman (USA). Dept. of Earth Sciences). Aug 1982. Contract AC13-76GJ01664. 163p. NTIS PCE06/MF A01. Order Number DE82020026.

Includes 2 sheets of 24x reduction microfiche. Portions of document are illegible.

The Bozeman Quadrangle, Montana, was evaluated to identify and delineate areas containing environments favorable for uranium deposits. This evaluation was conducted using methods and criteria developed for the National Uranium Resource Evaluation program. General surface reconnaissance, mapping, radiometric traverses, and geochemical sampling were performed in all geologic environments within the quadrangle. Aerial radiometric and HSSR data were evaluated and followup studies of these anomalies and most of the previously known uranium occurrences were conducted. Detailed gravity profiling was done in the Tertiary Three Forks-Gallatin Basin and the Madison and Paradise Valleys. Also, selected well waters were analyzed. Eight areas are considered favorable for sandstone uranium deposits. They include the Tertiary Three Forks-Gallatin basin, the Madison and Paradise Valleys, and five areas underlain by Cretaceous fluvial and marginal-marine sandstones. Other environments within the quadrangle are considered unfavorable for uranium deposits when judged by the program criteria. A few environments were not evaluated due to inaccessibility and/or prior knowledge of unfavorable criteria.

56246 (PGJ/F—081-82) National uranium resource evaluation: Dalhart Quadrangle, Texas, New Mexico, Oklahoma, Colorado, and Kansas. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Consulting Professionals, Inc., Santa Fe, NM (USA)). Aug 1982. Contract AC13-76GJ01664. 145p. NTIS PCE06/MF A01. Order Number DE82020023.

Includes 3 sheets of 24x reduction microfiche. Portions of document are illegible.

The Dalhart Quadrangle has yet to produce minable uranium deposits. Consulting Professionals, Inc., located four favorable environments in this evaluation, including the first recognition in the Great Plains area of the Morrison Formation as a potential host for uranium deposits. The complex Jurassic-age Morrison Formation in the quadrangle proved to be the richest possible source; two favorable areas were delineated. One, Area A, is a channel sandstone outcrop showing anomalous radioactivity with one sample assayed at 0.17% U_3O_8. A second favorable area of Jurassic age in the Morrison Formation, Area B, is in an exposed marlstone interval covering about 800 km². Area B may have an average U_3O_8 concentration of 0.01%, representing a deposit of as much as 100 million lb of U_3O_8 in an interval averaging about 0.5 m in thickness. Favorable Area C is in the Triassic Dockum Group and contains two intervals of anomalous radioactivity. Area D is in the Permian-Pennsylvanian sedimentary sequence and contains two zones of anomalous radioactivity in the arkosic sediments.

56247 (PGJ/F—097-82) National Uranium Resource Evaluation: Manhattan Quadrangle, Kansas. Fair, C.L.; Smit, D.E. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations; Wichita State Univ., KS (USA)). Aug 1982. Contract AC13-76GJ01664. 131p. NTIS PCE06/MF A01. Order Number DE82020025.

Includes 1 sheet of 24x reduction microfiche. Portions of document are illegible.

Surface reconnaissance and detailed subsurface studies were conducted in the Manhattan Quadrangle, Kansas, to evaluate uranium favorability using National Uranium Resource Evaluation criteria. These studies were designed in part to follow up airborne radiometric and hydrogeochemical and stream-sediment surveys. More than 600 well records were examined in the subsurface phase of the study. Results of these investigations indicate environments favorable for channel-controlled peneconcordant sandstone uranium deposits in Cretaceous rocks and for Wyoming roll-type deposits in Pennsylvanian sandstones. The Cretaceous sandstone environments exhibit such favorable characteristics as a bottom unconformity, high bed load, braided fluvial channels, large-scale cross-bedding, and one anomalous outcrop. The Pennsylvanian sandstone environments exhibit such favorable characteristics as arkosic cross-bedded sandstones, included pyrite and organic debris, interbedded shales, and gamma-ray log anomalies. Environments considered unfavorable for uranium deposits are limestone and dolomite environments, marine black shale environments, evaporative precipitate environments, and some fluvial sandstone environments. Environments considered unevaluated because not enough data were available include Precambrian plutonic, metamorphic, and sedimentary rocks, even though a large number of thin sections were available for study.

56248 Estimation of uranium endowment by subjective geological analysis - a comparison of methods and estimates for the San Juan Basin, New Mexico. Harris, D.P.; Carrigan, F.J. (Univ of Ariz, Tucson, USA). *Economic Geology and the Bulletin of the Society of Economic Geologists;* **76**: No. 5, 1032-1055(Aug 1981).

This study investigates how estimates of uranium endowment made by a geologist using an appraisal system that is based upon a formalization of geoscience and decision rules compare with estimates made by informal and unconstrained intuitive processes. Estimates of the uranium endowment of the San Juan Basin of New Mexico by four methodologies are compared in this study. The method are ranked by degree of decomposition (mitigating of heuristic bias) and control on hedging. The results prompt the suggestion that the more decomposed and formalized the estimation procedure, the greater the expected value and the variance of uranium endowment. Predicating estimation on that part of the geologist's geoscience useful in making U/sub 3/O/sub 8/ endowment estimates and upon his understanding of the region's geologic history produced larger estimates than previously reported. Refs.

0503 Mining

REFER ALSO TO CITATION(S) 56384

56249 (PB—82-158577) Uranium mine ventilaton costs. Information circular/1981. Bates, R.C. (Bureau of Mines, Washington, DC (USA)). Dec 1981. 24p. (BM-IC—8855). NTIS, PC A02/MF A01.

This Bureau of Mines report converts published data on the cost of ventilating uranium mines to a common price base and analyzes there data to determine the cost per ton of uranium ore at various levels of radiation exposure control. There appears to be an exponential increase of cost as the radiation level is lowered. The 1967 base costs are extrapolated to present dollars, and some cost comparisons are given for other radiation control measures.

0504 Feed Processing

REFER ALSO TO CITATION(S) 56390

56250 (PB—82-158957) Extracting uranium from carbonaceous ores. Report of investigations/1981. Schultze, L.E.; Bauer, D.J.; Morimoto, M.T. (Bureau of Mines, Reno, NV (USA). Reno Research Center). Dec 1981. 18p. NTIS, PC A02/MF A01.

As part of its goal of maintaining an adequate supply of minerals to meet national economic and strategic needs, the Bureau of Mines devised a processing sequence for recovering uranium from carbonaceous ores. Uranium extractions of 97 pct were obtained by contacting the ore with a solution containing 400 grams of ferric sulfate hydrate in 200 ml water for 3 hr at boiling temperature (96°). Uranium was recovered from the leaching solution by solvent extraction with tri-issooctyl amine. The barren ferric sulfate solution was recycled to the leaching system. The leaching process resulted in no detectable dissolution of carbonaceous material from the ore.

56251 Effects of organic and aqueous phase composition on uranium extraction from phosphoric acid with octylphenyl acid phosphate. Arnold, W.D.; McKamey, D.R.; Baes, C.F. Jr. (Oak Ridge Natl Lab, Tenn, USA). *Industrial and Engineering Chemistry Process Design and Development;* **21**: No. 2, 301-308(Apr 1982).

Octylphenyl acid phosphate (OPAP) is a commercially available mixture of monooctylphenyl phosphoric acid (MOPPA) and dioctylphenyl phosphoric acid (DOPPA) that is used to extract U/sup IV/ from wet-process phosphoric acid. The uranium extraction coefficient and the organic phase iron loading were not affected by changes in the organic phase composition due to hydrolysis of the extractant or by different MOPPA/DOPPA ratios in two OPAP batches. The effect of aqueous phase composition was studied in a factorial design test and also by varying the concentrations of the components individually over a range typical of their concentrations in wet-process phosphoric acid. Uranium extraction was decreased by increasing the concentrations of total phosphate, ferric iron, hydrofluoric acid, or total sulfate, and increased by increasing the concentrations of aluminum, magnesium, or silicon. 6 refs.

56252 Technology and economics of uranium recovery from phosphate resources. De Voto, R.H.; Stevens, D.N. (Earth Science Inc.). pp 109-138 of Uranium resource technology, Seminar 3, 1980. Morse, J.G. (ed.). Golden, CO; Colorado School of Mines Press (1980).

From 3. uranium resource technology seminar; Golden, CO, USA (10 Mar 1980).

This report evaluates the technical and economic feasibility of production of uranium as a by-product, co-product, or single product from uraniferous phosphate resources. These analyses show that from 1979 until the year 2025 between 4 and 28% of the United States' projected uranium requirements could be supplied by uranium extracted as a by-product from domestic phospheric acid production. Similarly, between 7 and 19% of the uranium requirements of the world outside the Communist bloc (including the United States) could be supplied from phosphoric acid.

0505 Enrichment

REFER ALSO TO CITATION(S) 58346

56253 (UVA-ER—746-82U) Simulation of countercurrent flow in a gas centrifuge. Greenspan, H.P. (Massachusetts Inst. of Tech., Cambridge (USA)). 22 Apr 1982. Contract AC05-82OR20900. 19p. NTIS, PC A02/MF A01. Order Number DE82018335.

Certain effects of geometry and configuration on the circulation patterns in a gas centrifuge can be readily explored and tested in a liquid simulator. Since the most interesting situations involve countercurrent flows, the simulator must be one in which such motion is both easy to produce and accessible for experimentation. An apparatus that seems to meet these requirements is a partially filled rotating cylinder, which has one endplate that rotates with a slightly different angular velocity. The device, shown schematically can be modified to produce source-sink or mass driven flows as well. The rotation rates, fluid volume fraction (i.e., the thickness of the fluid layer) and the fluid rheology are the main control factors to be set in any experiment.

56254 **Advanced isotope separation cascade design considerations.** Pendergrass, J.H. (LANL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **39**: 201(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56255 **Economics of new enrichment processes.** Vanstrum, P.R.; McGill, R.M. (Union Carbide Corp, Oak Ridge, Tenn). pp 1-25 of Atomic Industry Forum, fuel cycle conference '81, 1981. Washington, DC; Atomic Industry Forum (1981).

From Fuel cycle conference; Los Angeles, CA, USA (15 Mar 1981).

Some economic features are discussed of various enrichment technologies, including not only the diffusion process but also the centrifuge process which is being deployed on a production scale and three very promising advanced isotope separation (AIS) processes which are being developed. Brief discussion is presented on some of the other considerations which are considered important in evaluating and analyzing possible enrichment plans. These factors, along with process economics, can guide the application, deployment, and timing of an optimum mix of these processes into the next century.

0506 By-products

56256 **(AD-A—108972/1) Recycling/disposal alternatives for depleted uranium wastes. Final report 12 Jun-12 Sep 80.** Bucci, S.A.; Nalbandian, J.Y.; Kagan, D.M. (Analytic Sciences Corp., Reading, MA (USA)). Jan 1981. 89p. (TASC-TR—3236). NTIS, PC A05/MF A01.

All depleted uranium (DU) waste generated during test activities and from unused war reserve is subject to disposal as low-level radioactive waste. At present there is no operational alternative to sending DU wastes to commercial disposal sites for burial. Because of the uncertainties associated with the use of commercial sites in the future, the Air Force is seeking to identify and evaluate feasible recycling/disposal alternatives for the disposition of its DU wastes. In this report, potential recycle and disposal options are defined and briefly characterized. For each form of the DU waste, benefits and issues of applicable recycling/disposal alternatives are identified. Based on a comparative evaluation of these options, the most promising mode(s) of disposition are indicated for each type of waste material. The responsibilities and key regulations of government agencies pertaining to the management of low-level radioactive waste are given in the appendix.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 56417, 56785, 57443, 58000

56257 **(CEA-R—5139) Cations redistribution in mixed oxides $(U,Ce)O_2$ and $(U,Pu)O_2$ under thermal gradient.** Jean-Baptiste, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Paris-11 Univ., 91 - Orsay (France)). Oct 1981. 228p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE82701970.

Thesis.

Redistribution of cerium and uranium have been investigated in (Usub(0.7)Cesub(0.3))Osub(2-x) oxide subjected to a temperature gradient in laboratory experiments, in order to apply the results to the nuclear fuel $(UPu)O_2$. Cylindrical specimens in sealed molybdenum containers were exposed to temperatures up to 2400°C and longitudinal thermal gradients of 1500°/cm generated by an image furnace. Stoechiometry of the samples has been determinated from measurements of the oxygen chemical potential with a solid electrolyte probe (ThO_2-Y_2O_3). The chemical interdiffusion coefficient Dsub(UO_2/CeO_2) has been established in a temperature range from 1400°C to 2400°C. Our investigations of cations thermal diffusion in $(UCe)O_2$ have given evidence of a fast cations migration by an evaporation-condensation mechanism, and emphasize the strong correlation between oxide stoechiometry and the degree of redistribution, as well as the role of the initial density. A model based on vapour transport of metal-bearing species is set up, which describes our experiments and the influence of the various parameters (temperature, density, (O/M) ratio) with a good agreement. This treatment, applied to the post-irradiation experimental data, gives a correct description of in-pile cations redistribution, even for high burnup, without introducing any hypothetic SORET effect.

56258 **Electrical conductivity of pure and yttria-doped uranium dioxide.** Dudney, N.J.; Coble, R.L.; Tuller, H.L. (MIT, Cambridge, Mass, USA). *Journal of the American Ceramic Society;* **64**: No. 11, 627-631(Nov 1981).

The effects of doping urania on electronic conductivity at low oxygen partial pressures were investigated. Yttrium enhances the p-type electronic conductivity for near-stoichiometric oxygen concentrations. The hole concentration in pure urania was calculated as a function of the degree of nonstoichiometry and temperature and then compared to models for the formation of defect clusters. Increasing numbers of mobile holes created per excess oxygen ion with increasing temperature indicate that the holes must dissociate from the oxygen defect clusters at high temperature. 31 refs.

56259 **Thermal conductivity of powder beds - a model, some measurements on UO_2 vibro-compacted microspheres, and their correlation.** Hall, R.O.A.; Martin, D.G. (Oak Ridge Natl Lab, Tenn, USA). *Journal of Nuclear Materials;* **101**: No. 1-2, 172-183(Oct 1981).

An analytical model is developed based on one due to Deissler and Eian, but extended to include low gas pressures, when the powder bed conductivity is a function of pressure, and also high temperatures, when radiation between adjacent particles becomes a significant heat transfer mechanism. Four powder beds, comprising various combinations of 35, 300 and 1200/mu/m diameter microspheres, were measured in helium, nitrogen and krypton at pressures up to 0.6 MPa over the temperature range 370-1170 K. A method of calculating temperature jump distance values from conductivity measurements is developed. 9 refs.

56260 **Development of uranium fabrication techniques for plutonium production piles.** Schumar, J.F. (Argonne Natl Lab, Ill, USA). *Journal of Nuclear Materials;* **100**: No. 1-3, 31-35(Sep 1981).

The author describes the early efforts to extrude, machine, roll and draw uranium. 2 refs.

56261 **Subcritical limits for plutonium systems.** Clark, H.K. (DuPont, Aiken, SC). *Nuclear Science and Engineering;* **79**: No. 1, 65-84(Sep 1981).

As a contribution to a required review of American National Standard for Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors, limits for plutonium systems have been recalculated to confirm their subcriticality under the stated conditions or to propose other values. This paper presents calculation methods and results. The validity of each calculation method was established by extensive correlation with critical experiments, and in some cases with experiments performed subsequent to the original limit calculations. 48 refs.

56262 **Comparison of experimentally determined spent fuel compositions with ORIGEN2 calculations.** Croff, A.G. (ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **39**: 215-217(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56263 **Spent fuel composition: a comparison of predicted and measured data.** Cobb, D.D.; Ostenak, C.A.; Thomas, C.C. Jr. (LANL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **39**: 323-326(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 56261, 56306, 56392, 56402, 56417, 56757, 57087

56264 **(CEA-CONF—5992) Chemical problems associated with reprocessing.** Chesne, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Section d'Etude des Procedes Avances). Sep 1981. 12p. (CONF-810948—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702341.

From Actinides-1981 conference; Pacific Grove, CA, USA (10 Sep 1981).

This paper is an attempt to pinpoint the chemical problems raised by the reprocessing of oxide base fuels. Taking the reprocessing of slightly irradiated metallic fuels as a reference, for which long experience has been gained, a review is made of the various stages of the Purex process, in which the increase in mass and activity of the actinides and fission products engenders constraints related to the recovery of fissile materials, their purification, the release rate and, in general, the operation of the installations. The following subjects are discussed: dissolution from the standpoint of dissolution residues and iodine trapping, extraction cycles with respect to the behavior of ruthenium, neptunium, plutonium, technetium and palladium, the recycling of medium activity wastes.

56265 **(PNCT—841-80-71) Calculation code TRANPES for transitional Purex process.** Gonda, K.; Takiguchi, T.; Fukuda, S. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Sep 1980. 165p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82702216.

A new calculation code TRANPES has been developed to have a continuous knowledge on the actual material present at any stage and any time in an mixer-settler type extractor. TRANPES makes continuous estimation of the concentration profiles of plutonium, uranium and acid in every stage of an extractor by calculating on the basis of the operating data shown below. 1) Feed concentrations and flow rates to an extractor. 2) Height of aqueous-organic interface level at each stage of an extractor. 3) Concentrations of plutonium, uranium and acid observed in several selected stages by in-line monitoring instruments and chemical analysis. The present computor code can search the parameters for calculation by transitional least-squares fitting method. TRANPES can also evaluate the influence of measurement errors of concentrations observed upon concentrations calculated and show confidence region of the concentrations calculated.

56266 **(PNCT—841-81-35) Transuranium elements partition calculation code Advanced MIXSET for Purex process.** Nemoto, T.; Miyachi, S.; Gonda, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Apr 1981. 283p. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. Order Number DE82702218.

Many solvent extraction studies of transuranium elements have been reported, but the partition profile of transuranium elements has been scarcely simulated. So, to simulate the partition profile of transuranium elements such as neptunium, americium and curium, transuranium elements partition calculation code, Advanced MIXSET has been developed. In the present study, distribution coefficients of transuranium elements such as Np(IV), Np(V), Np(VI), Am(III) and Cm(III) and the redox reactions of neptunium were rearranged numerically with the data in the published literatures. Advanced MIXSET has been made by reforming the previous Revised MIXSET to give an option to calculate transuranium elements partition in the Purex process. This Advanced MIXSET code has been verified to be useful by the good agreements between the simulated and the concentration profiles of neptunium recovery flowsheets of the PNC and Karlsruhe, respectively.

56267 **(PNL—4116) Preliminary investigation of a technique to separate fission noble metals from fission-product mixtures.** Mellinger, G.B.; Jensen, G.A. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1982. Contract AC06-76RL01830. 47p. NTIS, PC A03/MF A01. Order Number DE82020249.

A variation of the gold-ore fire assay technique was examined as a method for recovering Pd, Rh and Ru from fission products. The mixture of fission product oxides is combined with glass-forming chemicals, a metal oxide such as PbO (scavenging agent), and a reducing agent such as charcoal. When this mixture is melted, a metal button is formed which extracts the noble metals. The remainder cools to form a glass for nuclear waste storage. Recovery depended only on reduction of the scavenger oxide to metal. When such reduction was achieved, no difference in noble metal recovery efficiency was found among the scavengers studied (PbO, SnO, CuO, Bi_2O_3, Sb_2O_3). Not all reducing agents studied, however, were able to reduce all scavenger oxides to metal. Only graphite would reduce SnO and CuO and allow noble metal recovery. The scavenger oxides Sb_2O_3, Bi_2O_3, and PbO, however, were reduced by all of the reducing agents tested. Similar noble metal recovery was found with each. Lead oxide was found to be the most promising of the potential scavengers. It was reduced by all of the reducing agents tested, and its higher density may facilitate the separation. Use of lead oxide also appeared to have no deterimental effect on the glass quality. Charcoal was identified as the preferred reducing agent. As long as a separable metal phase was formed in the melt, noble metal recovery was not dependent on the amount of reducing agent and scavenger oxide. High glass viscosities inhibited separation of the molten scavenger, while low viscosities allowed volatile loss of RuO_4. A viscosity of $\sim$ 20 poise at the processing temperature offered a good compromise between scavenger separation and Ru recovery. Glasses in which PbO was used as the scavenging agent were homogeneous in appearance. Resistance to leaching was close to that of certain waste glasses reported in the literature. 12 figures. 7 tables.

56268 **Adjoint gamma-ray estimation to the surface of a cylinder-analysis of a remote reprocessing facility.** Cramer, S.N. (Oak Ridge Natl Lab, Tenn). *Nuclear Science and Engineering;* **79**: No. 4, 417-425(Dec 1981).

The next-event estimator in the MORSE multigroup Monte Carlo code has been extended to include Klein-Nishina scattering and annihilation radiation from pair production for both the forward and adjoint modes of calculation. A formulation for the solid angle subtended at a point by a cylinder has also been used in the estimator. These procedures have been included in the investigation of the gamma-ray environment of a remote fuel reprocessing facility. Calculational results are presented which indicate the validity and efficiency of the developed methods as compared to those in standard use. 12 refs.

56269 **Removal of trace contaminants from recycle nitric acid.** Clark, W.E.; Howerton, W.B.; Mailen, J.C. (Oak Ridge Natl Lab, Tenn, USA). *Nuclear Technology;* **53**: No. 2, 235-240(May 1981).

Extensive recycle of nitric acid and water in a nuclear fuel reprocessing plant can result in the build-up of deleterious trace impurities; identified materials of serious concern include fluoride, chloride, and organic materials. Methods for removal of these deleterious materials must be developed to allow increased aqueous recycle. Fluoride at 10 to 100 /mu/g/ml can be removed from 10 M HNO/sub 3/ using a silica gel column. Chloride can be removed from 10 M HNO/sub 3/ by sparging with ozonized air, a method that is rapid even at room temperature. Carbonaceous material can be removed by pressurized aqueous combustion and by ozonation. 11 refs.

56270 **Alternatives for disposal of krypton-85.** Christensen, A.B.; Debbio, J.A. D.; Knecht, D.A.; Tanner, J.E. (Exxon Nuclear Idaho, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **39**: 172(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56271 Tritium and fission product behavior during irradiated fuel heat treatments. Campbell, D.O.; Pattison, W.L. (ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **39**: 219(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56272 Thermal outgassing of irradiated fuel. Bray, L.A.; Burger, L.L.; Morgan, L.G. (PNL, Richland, WA 99352,). *Transactions of the American Nuclear Society;* **39**: 219-220(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56273 Analysis of critical experiments with Monte Carlo and ENDF/B-V data. Eisenhart, L.D.; Todosow, M. (BNL, Upton, NY 11973). *Transactions of the American Nuclear Society;* **39**: 536-537(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

0509 Transport And Storage

REFER ALSO TO CITATION(S) 56356, 56411, 56413

56274 (CONF-810738—, pp 25-34) **PAT-2 (Plutonium Air Transportable Model 2).** Anderson, J. Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The PAT-2 (Plutonium Air Transportable Model 2) package is designed for the safe transport of plutonium and/or uranium in small quantities, especially as used in international safeguards activities, and especially as transported by air. The PAT-2 package is resistant to severe accidents, including that of a high-speed jet aircraft crash, and is designed to withstand such environments as extreme impact, crushing, puncturing and slashing loads, severe hydrocarbon-fueled fires, and deep underwater immersion, with no escape of contents. The accident environments may be imposed upon the package singly or seqentially. The package meets the requirements of 10 CFR 71 for Fissile Class I packages with a cargo of 15 grams of Pu-239, or other isotopic forms described herein, not to exceed 2 watts of thermal activity. Packaging, operational features, and contents of package, are discussed.

56275 (NUREG—0383-V1-REV-1) Directory of certificates of compliance for radioactive materials packages: summary report of NRC approved packages. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Dec 1981. 388p. NTIS, PC A17/MF A01.

This directory contains a Summary Report of NRC approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the U.S. Nuclear Regulatory Commission. To assist in identifying packaging, and index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory.

56276 (NUREG—0383-V2-REV-4) Directory of certificates of compliance for radioactive materials packages. Volume 2. Certificates of compliance (Revision 4). (Nuclear Regulatory Commission, Washington, DC (USA)). Dec 1981. 621p. NTIS, PC A99/MF A01.

This directory contains a Summary Report of NRC approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the U.S. Nuclear Regulatory Commission. To assist in identifying packaging an index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory.

56277 (NUREG—0383-V3-Rev.1) Directory of certificates of compliance for radioactive materials packages. Volume 3, revision 1. Summary report of NRC approved quality assurance programs for radioactive material packages. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Fuel Cycle and Material Safety). Dec 1981. 140p. NTIS, PC A07/MF A01.

The directory contains a Summary Report of NRC approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the U.S. Nuclear Regulatory Commission. To assist in identifying packaging, and index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory.

56278 (NUREG/CR—2440) Transport of low specific activity radioactive materials. Final report. Colton, J.D.; Krebs, J.S.; Boswell, R.E.; Thompson, C.R.; Smith, C.F. (SRI International, Menlo Park, CA (USA)). Dec 1981. 166p. NTIS, PC A08/MF A01.

Data on LSA shipments were collected for ores and for LSA waste. Data on waste shipments were collected from the three commercial waste disposal sites in the United States. These data were analyzed to represent LSA shipments in terms of general material description, container type, activity level, and radionuclides present.

56279 (NUREG/CR—2842) Transportation of radioactive material in South Carolina, October 1980-September 1981. (South Carolina Dept. of Health and Environmental Control, Columbia (USA). Bureau of Radiological Health). Jul 1982. 34p. GPO $4.50.

During the fourth and final year of this contract, transportation of radioactive materials into and within South Carolina was studied. The majority of the presented data results from inspections of shipments containing low-level radioactive wastes. A small number of packages containing other radioactive materials were also inspected. Although the study determined that violations of State and Federal regulations still exist, the results indicate a significant decrease in the number of violations over the study period from October 1978 through September 198(1) This may be attributed to the enforcement of new legislation and increased efforts of field inspectors. The following recommendations are offered: (1) The Department of Transportation should increase the emphasis on carrier equipment inspections. (2) Clarification and revision of Motor Carrier Safety regulations is needed. This should include provisions for required, frequent carrier inspections of equipment. (3) Carriers and drivers should be trained and knowledgeable as to their responsibilities and in applicable regulations.

56280 (NUREG/CR—2852) Transportation of radioactive material in Nevada, September 1980-September 1981. (Nevada Dept. of Human Resources, Carson City (USA). Div. of Health). Jul 1982. 21p. GPO $3.50.

This report describes a study conducted by the State of Nevada between September 1980 and September 1981, concerning the transportation of radioactive materials. Data is presented on the surveillance of airport terminals, inspection of shipments of radioactive waste to the state disposal site, and on the transportation of radioactive materials to the largest user in the state, the Nevada Test Site. It was noted in the metropolitan areas that taxicabs were used in the delivery of medical isotopes. The major recommendations resulting from the study were: future state surveillance should include hazardous materials, the US Department of Transportation should tell the state the results of its enforcement, and the US Nuclear

Regulatory Commission should inspect its licensees packaging of radioactive waste.

56281 **(PNL-SA—10385-A) Wet storage of spent fuel.** Bailey, W.J.; Johnson, A.B. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1982. Contract AC06-76RL01830. 12p. NTIS, PC A02/MF A01. Order Number DE82014846.

This paper briefly outlines the status of wet storage of spent fuels in the United States. The following information is presented: number of LWR fuel assemblies in wet storage; location, type, cladding and failed fuel of stored spent fuel assemblies; storage capabilities; current trend (extend burnup); basis for assessing spent fuel behavior in wet storage; handling operations with spent fuel. The report summarizes that there have been no problems encountered in the storage of spent fuels in pools, and that there is no evidence of fuel cladding degrading in wet storage. (ATT)

56282 **(SKBF-KBS-INF—11) Scrutiny of KBS-2 Final storage of spent nuclear fuel. The summaries of the reviewers, November 1981.** (Swedish Nuclear Fuel Supply Co., Stockholm). Nov 1981. 35p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702207.

The KBS-2 report which dealt with the final storage of spent fuel without reprocessing has been examined by 32 domestic and foreign bodies of experts. Summaries of the commentaries are presented.

56283 **Geotechnical status report for test storage of spent reactor fuel in climax granite, Nevada Test Site.** Wilder, D.G.; Patrick, W.C. (Lawrence Livermore Natl Lab, Calif). *Bulletin of the Association of Engineering Geologists;* **18**: No. 4, 355-367(Nov 1981).

The basic objective of the spent fuel test described is to determine the feasibility of safe and reliable short-term storage and the subsequent retrieval of spent reactor fuel assemblies at a plausible repository depth in a granitic rock. Eleven Westinghouse PWR spent fuel assemblies from Turkey Point Unit No. 3 (Florida) have been interspersed with six electrical heaters to compare the effects caused by heat alone with those of heat and radiation. 19 refs.

56284 **Criticality experiments with subcritical clusters of 2.35 and 4.31 Wt% ^{235}U-enriched UO_2 rods in water with steel reflecting walls.** Bierman, S.R.; Clayton, E.D. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *Nuclear Technology;* **54**: No. 2, 131-144(Aug 1981).

A research program, funded by the U.S. Nuclear Regulatory Commission (NRC), to provide experimetal criticality data on conditions simulating light water reactor (LWR) fuel shipping and storage configurations was begun in 1976 at the Battelle-operated Critical Mass Laboratory at Hanford. The results of four sets of experiments in this program have been reported in previous NRC documents. The results from a fifth set of experiments are covered in this paper and involve two fuels immersed in water. 7 refs.

56285 **Depleted uranium dioxide powder flow through very small openings.** Sutter, S.L.; Johnston, J.W.; Owzarski, P.C.; Mishima, J.; Schwendiman, L.C. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *Nuclear Technology;* **52**: No. 1, 100-104(Jan 1981).

Release of plutonium dioxide from a breached shipping container was simulated using depleted uranium dioxide. Microgram quantities of the powder were carried by pressurized air through very small openings in a vessel approximately the same dimensions as a shipping container. Powder transmission was measured as a function of upstream pressure above and below the static powder level. 3 refs.

56286 **Predicting fuel integrity for dry spent fuel storage.** Cash, R.J.; Davison, R.H.; Einziger, R.E. (Westinghouse Hanford, Richland, WA 99352). *Transactions of the American Nuclear Society;* **39**: 187-189(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56287 **Effects of storage site location and transportation parameters on spent fuel cask projections.** Cashwell, J.W.; Joy, D.S.; McGuire, S.C. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **39**: 189-190(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56288 **Evaluation of proposed methods of radioactive material container tie-down design for truck transport.** Lamoreaux, G.H. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **39**: 192(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56289 **Impacts on defense waste management strategy on transuranic waste transportation requirements.** Andrews, W.B.; Code, B.M.; Engel, R.L.; Oylear, J.M. (PNL, Richland, WA 99352). *Transactions of the American Nuclear Society;* **39**: 226-227(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 56225

56290 **Experiences in the evolution of an automated cost estimating system.** Van Wie, N.H. (Union Carbide Corp., Oak Ridge, TN). *Transactions of the American Association of Cost Engineers;* 297-302(1977). (CONF-770631—).

From 21. American Association of Cost Engineers annual meeting; Milwaukee, WI, USA (26 Jun 1977).

Union Carbide's engineering groups are normally involved in the conceptual design phase of several dozen concurrent projects. At present, the project of largest magnitude is an add-on to ERDA's uranium isotope enrichment plant at Portsmouth, Ohio. This project is expected to cost approximately $4.5 billion, at projected escalation rates. For this, and other projects expected to cost $25 billion or more, ERDA sets standards for cost analysis and reporting that would be very costly to adhere to if hand computations were the sole medium available. The add-on plant estimates are based on about 900 bills of material, the basic work package of an estimate. Hence, there is a strong motivation to automate the estimating process for the threefold reasons of accountability, magnitude, and frequency. Union Carbide's automated system was not designed and developed as a turnkey package. It evolved from the manual system and was thus subject to close scrutiny and audit throughout every phase of its evolution. This paper describes Carbides experiences from the point of view of the applications programming group responsible for implementing this system. It is organized around the essential components of any estimating system, manual or automated. The data files, the computational requirements, and the resulting products are described, along with some speculative remarks about opportunities for future development.

0520 Waste Management

REFER ALSO TO CITATION(S) 56256, 56270, 56282, 56283, 56289, 56377, 56378, 56379, 56380, 56381, 56382, 56383, 56385, 56387, 56388, 56389, 56391, 56414, 56798, 56944, 57008, 57087, 57499, 57500, 57977, 58138, 58139, 58180, 58274, 58280, 58281, 58284, 59038

56291 **(AD-A—111275/4) Composition of rock core from hole AEC-8, New Mexico. Final report.** Rhoderick, J.E.; Buck, A.D. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.). Dec 1981. 23p. NTIS, PC A02/MF A01.

AEC-8 is a borehole about 5000 ft deep located within the Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico. About 28 ft of rock core from seven depth intervals in this hole was characterized by petrographic examination. This included logging, examination of the rock with a stereomicroscope, examination of thin sections with a polarizing microscope, and examination of each sample by X-ray diffraction. The following rock types were identified: (1) Reddish sandstone; (2) Reddish silty claystone; (3) Impure grayish anhydrite; (4) Grayish gypsiferous dolomite; (5) Brownish siltstone; and (6) Colorless to reddish halite.

56292 **(BNL-NUREG—31328) Some aspects of low-level radioactive-waste disposal in the US.** Schweitzer, D.G.; Davis, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 12p. (CONF-8206106—2). NTIS, PC A02/MF A01.

From 14. conference on nuclear safety; Tokyo, Japan (4 Jun 1982).

This report summarizes the NRC supported Shallow Land Burial research program at Brookhaven National Laboraotry and its relationship to the proposed revised ruling on disposal of low level radioactive waste, 10 CFR Part 61. Section of the proposed regulation, which establish the new low level waste classification system and the performance objective placed on waste form, are described briefly. The report also summarizes the preliminary results obtained from the EPA program in which low level waste drums were retrieved from the Atlantic and Pacific Oceans.

56293 **(BNL-NUREG—31329) High-level-waste containment for a thousand years: unique technical and research problems.** Davis, M.S. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 8p. (CONF-8206106—1). NTIS, PC A02/MF A01.

From 14. conference on nuclear safety; Tokyo, Japan (4 Jun 1982).

In the United States the present policy for disposal of high level nuclear wastes is focused on isolation of solidified wastes in a mined geologic repository. Safe isolation is to be achieved by utilizing both natural and man-made barriers which will act in concert to assure the overall conservative performance of the disposal system. The incorporation of predictable man-made barriers into the waste disposal strategy has generated some new and unique problems for the scientific community.

56294 **(CEA-CONF—6054) Experience in containment and leaching of PWR wastes embedded into the cement.** Bernard, A.; Nomine, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). Oct 1981. 17p. (In French). (CONF-811056—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702203.

From Seminar on the management of radioactive waste from nuclear power plants; Karlsruhe, F.R. Germany (5 Oct 1981).

The growth of the important French electro-nuclear programme (900 and 1300 MWe PWR reactors, fast neutrons) corresponds to the production of low and medium level radioactive wastes that must be efficiently solidified. The "Laboratoire des Betons et Revetements" of the Saclay Nuclear Study Centre has gained a certain experience on how to package such waste by means of hydraulic binders. It has also built up a data bank on the characteristics of the materials obtained. The purpose of this paper is to draw up a panorama of the actions relating the experience acquired in these fields.

56295 **(CEA-R—5137) Process of transformation of radioactive waste of metal sodium into soda solution by reaction with an alcohol followed by hydrolysis.** Chevalier, G.; Bruneau, C.; Brault, A.; Loyer, H.; Mathurin, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Sep 1981. 126p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82702204.

Reviews of the literature and of the laboratory tests are followed by a presentation of the results obtained during experiments carried out on a model with some ten grams of sodium contaminated by radioactive materials and on an industrial pre-pilot with several kilograms of non-contaminated sodium. Sodium is converted into alcoholate through the action of ethylcarbitol ($CH_3CH_2OCH_2CH_2OCH_2OH$) on liquid sodium in suspension in xylene at 110 deg C. Once the reaction is complete, xylene is distilled and the alcoholate is in solution in an axcess of alcohol. Hydrolysis by water gives out the initial alcohol which is then extracted from the aqueous phase by toluene. All these operations are carried out in inert atmosphere (nitrogen). Sodium is thus converted into a sodium hydroxide aqueous solution with emission of hydrogen, the intermediate products (alcohol, xylene, toluene) being recyled. The process is reliable and recycling of organic products is favourable economically. The advantage of the method is to concentrate nearly all the radioactivity of the contaminated sodium in the aqueous phase, thus avoiding the dispersion of activity especially with the gaseous effluents. Finally, data are given allowing to consider the realization of a pilot with a weekly capacity of 100 kg of sodium, in semi-continuous operation.

56296 **(CNEN-RT/ING—81-12) Laboratory determination of the thermal properties of large-scale samples of natural clays.** Bocola, W.; Girolimetti, G.; Giulianelli, G.; Tassoni, E.; Testa, L. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Radiazioni e Ricerche di Sicurezza e Protezione). Jul 1981. 52p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82902983.

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The determination of the thermal properties is important in the evaluation of argillaceous formations as potential host rock for the geologic disposal of high level radioactive wastes. The present paper reports the heating tests, carried out on a large cubic block of clay ($1 = 80$ cm) by means of 3 small heaters, whose thermal power has been varied from 20 to 40 watt. The experimental results, which have been processed by the curve fitting method, show that the thermal diffusivity is about 20 cm^2/h, while the thermal conductivity range from 0.014 to 0.016 watt/cm °C.

56297 **(CONF-810528—16) Coating crystalline nuclear waste forms to improve inertness.** Stinton, D.P.; Angelini, P.; Caputo, A.J.; Lackey, W.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01. Order Number DE82015675.

From 83. symposium on nucleation and crystallization in glasses; Washington, DC, USA (3 May 1981).

Crystalline waste forms of high simulated waste loading were successfully coated with layers of pyrolytic carbon and silicon carbide. Sol-gel technology was used to produce microspheres that contained simulated waste. A separate process for cesium immobilization was developed, which loads 5 wt % Cs onto zeolite particles for subsequent coating. The chemical vapor deposition process was developed for depositing thin layers of carbon and silicon carbide onto particles in a fluidized-bed coater. Pyrolytic carbon-coated particles were extremely inert in numerous leach tests. Aqueous leach test results of coated waste forms were below detection limits of such sensitive analytical techniques as atomic absorption and inductively coupled plasma atomic emission.

56298 **(DOE/NBM—2020712) Alabama State Briefing Book for low-level radioactive waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); Southern States Energy Board, Atlanta, GA (USA)). Aug 1981. Contract AC07-76ID01570. 177p. NTIS, PC A09/MF A01. Order Number DE82020712.

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The Alabama State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. This report contains a profile of low-level radioactive waste generators in Alabama. The profile is the result of a survey of NRC licensees in Alabama. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Alabama.

56299 (DOE/NBM—2020717) **Iowa State Briefing Book for low-level radioactive waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); Politech Corp., Austin, TX (USA)). Aug 1981. Contract AC07-76ID01570. 201p. NTIS, PC A10/MF A01. Order Number DE82020717.

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The Iowa State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. This report contains a profile of low-level radioactive waste generators in Iowa. The profile is the result of a survey of NRC licensees in Iowa. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Iowa.

56300 (DOE/NBM—2020719) **Arkansas State Briefing Book for low-level radioactive waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); Southern States Energy Board, Atlanta, GA (USA)). Aug 1981. Contract AC07-76ID01570. 207p. NTIS, PC A10/MF A01. Order Number DE82020719.

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The Arkansas State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. This report contains a profile of low-level radioactive waste generators in Arkansas. The profile is the result of a survey of NRC licensees in Arkansas. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Arkansas.

56301 (DOE/NBM—2020720) **Georgia State Briefing Book for low-level radioactive waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); Southern States Energy Board, Atlanta, GA (USA)). 1 May 1981. Contract AC07-76ID01570. 184p. NTIS, PC A09/MF A01. Order Number DE82020720.

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The Georgia State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. This report contains a profile of low-level radioactive waste generators in Georgia. The profile is the result of a survey of NRC licensees in Georgia. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media soutces. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Georgia.

56302 (EGG-M—01781) **Programmable multi-timer for TRU waste analysis applications.** Lawrence, R.S.; Nieschmidt, E.B.; Tsang, F.Y. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 4p. (CONF-811012—50). NTIS, PC A02/MF A01. Order Number DE82007336.

From IEEE symposium on nuclear science; San Francisco, CA, USA (21 Oct 1981).

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A programmable, multiple-function timing module has been developed for use in transuranic (TRU) waste analysis applications at the Idaho National Engineering Laboratory. The Programmable Multi-Timer (PRMT) is an expanded version of a module originally built for accelerator-based active photon interrogation experiments. During the course of the experiments, it became obvious that a more versatile timer was needed to meet several unforeseen requirements. The PRMT was designed to meet the new requirements and to serve as a general-purpose timing module for other applications.

56303 (ENPU—81-1) **Geological reconnaissance study of the Dyfi Valley region, Gwynedd/Powys, Wales.** Martin, B.A.; Howells, M.F.; Reedman, A.J. (Institute of Geological Sciences, London (UK); Natural Environment Research Council, London (UK)). Jan 1981. 63p. NTIS (US Sales Only), PC A04/MF A01; Available from Environmental Protection Unit, Institute of Geological Sciences, Harwell Laboratory, Oxfordshire. Order Number DE82702206.

A collation of existing maps and data backed up by localised checking, reinterpretation and modification, employing sampling, structural measurements and aerial photograph interpretation, have updated the geological information available on the Dyfi Valley region. The region comprises an argillaceous-dominated Ordovician and Silurian sedimentary pile of approximately 4 km thickness. Thick formations of mudstones and silty mudstones with thin intercalations of silty sandstone and fine-grained sandstone predominate and exhibit fewer variations in thickness and extent than the subordinate formations with a higher proportion of sand-grade material. Three periods of deformation (D_1-D_3) are distinguished, with the D_1 phase dominating the structure of the region by forming upright, asymmetrical, large (km) scale folds (F_1) of a NNE-SSW to NE-SW trend and producing an almost ubiquitous slaty cleavage (S_1). The succeeding deformations produced localised crenulation cleavages, kink bands and box folds. Data on the faulting and jointing associated with this deformation history are also presented.

56304 (INIS-mf—7092, pp vp) **Disposal sites of radioactive wastes from nuclear power plants and relating services.** Kortus, J. (Chemoprojekt, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

A brief description is presented of the technical layout of a regional disposal site for radioactive wastes from nuclear power plants including the transport of the waste to the site. Considered for permanent burial are solid and solidified low and medium level wastes in steel drums. Solidification will be carried out by bituminization. The values are given of dose rates at various distances from the drums. The conditions are given for the transport of radioactive materials to the storage site which meet the requirements of the IAEA. Recommended for the transport have been containers with alloy shielding, and the dose rates are given at various distances from the surface. The suggested disposal site is designed such as to preclude the spread of radioactive substances which could significantly increase the radiation burden of the population even under extreme conditions.

56305 (INIS-mf—7092, pp vp) **Safe disposal of radioactive wastes from nuclear power plants.** Malasek, E. (Ceskoslovenska Komise pro Atomovou Energii, Prague); Tittlova, E. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The principles are listed of the safe removal of radioactive wastes from nuclear power plants. The fuel cycle is represented with a detailed description of radioactive wastes and the typical annual amounts are given of wastes involved in the operation of a 1000 MWe light water reactor. These include wastes from the mining and processing of uranium ores, from uranium treatment and fuel production, from the operation of nuclear power plants, from the storage and reprocessing of spent fuel and from the decommissioning of nuclear installations after shut-down. Also discussed are the possibilities of the safe storage of radioactive wastes and it is stated that the only feasible solution for Czechoslovakia is their burial several metres underground with adequate insulation against water and covered with an earth layer. High level radioactive wastes are planned to be deposited in deep geological formations. The future trend in this field is indicated. (B.S.).

56306 (K/PS—5002) Noble gas removal and concentration by combining fluorocarbon absorption and adsorption technologies. Little, D.K.; Eby, R.S.; Norton, J.L.; Patton, J.L.; Schultz, R.M.; Varagona, J.M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 4 Aug 1982. Contract W-7405-ENG-26. 22p. (CONF-820833—8). NTIS, PC A02/MF A01. Order Number DE82019469.

From 17. DOE nuclear air cleaning conference; Denver, CO, USA (1 Aug 1982).

Since the late 1960s, the Oak Ridge Gaseous Diffusion Plant, in conjunction with the Oak Ridge National Laboratory, has developed a fluorocarbon-based selective absorption system for removal of ^{85}Kr and $^{14}CO_2$ from nuclear fuel reprocessing facilities. Process performance and reliability have been well demonstrated with over 10 years of operation using simulated reactor and reprocessing plant dissolver off-gases and three generations of pilot plant scale equipment. A major development of this work is a combination absorption and stripping column which results in a simplified process with improved reliability and lower cost. The process has shown excellent flexibility in simultaneously removing and concentrating the radioactive gases of interest, i.e., > 99% removal is easily obtainable for Kr, Xe, and CO_2. With the incoming feed gas containing around 10 ppM Kr, the product concentration of Kr from the single column is typically in the 1 to 10% range. Additional purification of the single-column product allows nearly pure components (> 90% Kr) to be obtained, thereby minimizing final storage or disposal requirements. Several alternatives for product purification have been investigated. In one system, 13X molecular sieve is used to first remove the process solvent vapor. Selective adsorption on 5A molecular sieves and silver mordenite is then used to separately remove the already concentrated CO_2 and Xe, respectively. At this point Kr, which was withdrawn from the column at the present concentration level, has now been further purified by the removal of the other components and can be collected in a cold trap. This paper summarizes the performance capabilities of the single-column and discusses product purification system options, including selective desublimation, solid sorbent, and cryogenic charcoal adsorption techniques.

56307 (LA—9219-MS) Floristic composition and plant succession on near-surface radioactive-waste-disposal facilities in the Los Alamos National Laboratory. Tierney, G.D.; Foxx, T.S. (Los Alamos National Lab., NM (USA)). Mar 1982. Contract W-7405-ENG-36. 60p. NTIS, PC A04/MF A01. Order Number DE82015894.

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Since 1946, low-level radioactive waste has been buried in shallow landfills within the confines of the Los Alamos National Laboratory. Five of these sites were studied for plant composition and successional patterns by reconnaissance and vegetation mapping. The data show a slow rate of recovery for all sites, regardless of age, in both the pinon-juniper and ponderosa pine communities. The sites are not comparable in succession or composition because of location and previous land use. The two oldest sites have the highest species diversity and the only mature trees. All sites allowed to revegetate naturally tend to be colonized by the same species that originally surrounded the sites. Sites on historic fields are colonized by the old field flora, whereas those in areas disturbed only by grazing are revegetated by the local native flora.

56308 (NCSU—80-4) Subsolidus sintering of SYNROC: I. Initial demonstrations. Solomah, A.G.; Hare, T.M.; Palmour, H. III. (North Carolina State Univ., Raleigh (USA)). Aug 1980. Contract AC09-80ET41902. 20p. NTIS, PC A02/MF A01. Order Number DE82019466.

Simulated High Level Radioactive Waste has been incorporated in sintered SYNROC-B Ceramic matrices prepared by subsolidus sintering techniques. Phase and compositional analyses have been carried out by x-ray diffraction techniques and scanning electron microscope equipped with energy dispersive analysis of x-ray (SEM/EDAX) analyses on fracture surfaces. Modified SNYROC-B compositions have been formulated based on computer-calculated ion substitutions relative to the stoichiometries of the major phases, [Hollandite (H), Perovskite (P), Zirconolite (Z)] and their respective abilities to retain HLW ions in their lattice structures, either substitutionally or interstitially. When prepared and sintered, the Modified SYNROC-B compositions yield clean H,P,Z assemblages, free of minor phases which might be questionable with respect to compatibility with major phases and HLW ions, and/or chemical and/or radiation stability under long-term disposal conditions. Chemical stability of the Modified SYNROC-B loaded with 10 and 15 wt% simulated HLW has been studied by leaching in pure distilled water at ~ 100°C and in simulated brines similar to those found in geologic disposal sites at their boiling temperatures (~ 110°C) at atmospheric pressure. High pressure, high temperature leaching in simulated brine has also been investigated at ~ 50 atm and 270°C for the Modified SYNROC-B Ceramic waste form loaded with 15 wt% simulated PW-4b radwaste. In all instances, the observed leach rates have been near or below (mostly below) present analytical detection limits (AAS or NAA).

56309 (NCSU—81-3) Subsolidus sintering of SYNROC: II. Materials selections, process improvements, waste form evaluations. Palmour, H. III.; Hare, T.M.; Russ, J.C.; Boss, C.B.; Solomah, A.G.; Batchelor, A.D. (North Carolina State Univ., Raleigh (USA)). Jul 1981. Contract AC09-81SR10957. 100p. NTIS, PC A05/MF A01. Order Number DE82019467.

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The principal areas of research were related to materials selections and characterization, process optimizations, crystalline phase development, sinterability, resultant microstructures and evaluations of leaching behavior. With and without simulated radwaste doping, the Modified SYNROC-B formulation was found to be sinterable to technical density (D > 0.95 in the CTS mode) at temperatures in the range 1195°C to 1285°C, depending upon TiO_2 and $CaCO_3$ materials selections, and upon powder processing methods employed prior to firing. Of the 16 TiO_2 raw materials evaluated in air-fired, undoped batches, 15 yielded technically dense compacts (D > 0.95). Three fine pigmentary grades of TiO_2 were selected for further study in doped and undoped versions fired in Ar, 4% H_2. When intensively milled with other well chosen matrix constituents and 10% spray-calcined simulated waste, each of them yielded sintered densities of $\geqq 4.2$ g/cm^3 ($D \geqq 0.96$) at 1260°C, 2h in Ar, 4% H_2 atmosphere. Leachability studies have been carried out in triple distilled H_2O according to MCC-1 and MCC-2 procedures at 25° and 150°C, respectively, and under γ-irradiation for dose rates of 2-5 x 10^5 rad/h at ~ 25°C. The results obtained showed that freshly exposed interiors of sintered Modified SYNROC-B ceramics were highly stable in the leaching environment, and were very retentive of simulated waste ions, including the most leachable species, Cs. Depending on leaching conditions, the highest Cs leach rates (after 3 days) were on the order of 10^{-1} g.m^{-2}.day^{-1}, but diminished sharply for longer times (up to 92 days) to the range 10^{-2} - 10^{-4} g.m^{-2}.day^{-1}.

56310 (NKA/AO—81-5) Enlarged Nordic cooperative program on nuclear safety. Nordic study on reactor waste: main report. (SEE CODE- 4700200 Nordic Liaison Committee for Atomic Energy, Risoe (Denmark)). Aug 1981. 116p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82903434.

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In 1981, 14 nuclear power reactors in operation and 2 under construction in the Nordic countries. So far, the reactor waste originating from day-to-day operation of these plants has been stored in solidified form at the reactor sites. Within a few years a satisfactory disposal procedure needs to be established. While the main R and D efforts in the waste field have earlier been devoted to the question of irradiated fuel and waste from reprocessing, there is therefore now an increased interest in reactor waste with its much lower radioactivity but somewhat larger volumes. Many of the methods developed to evaluate the safety of high level waste can also be applied to reactor waste. Furthermore, the principles used in nuclear reactor safety analysis are essentially applicable. The main difference is the difficulty in defining possible accident scenarios in the case of reactor waste management systems. Since 1977, efforts have been made in a joint Nordic study to examine which facts need to be known in order to perform a comprehensive safety assessment of a reactor waste management system, and how the results can be interpreted. It turns out that even in the absence of well-defined requirements from the regulating authorities it is quite feasible to evaluate the safety of a proposed waste management arrangement and to ensure a balanced and reasonable safety level in all sub-systems. In the present study a reference system related to the waste generated over 30 years from six 500 MW-reactors is examined. In the report it is demonstrated how a safety assessment can be carried out in detail and how the resulting doses can be presented together with their probabilities of occurrence. In some cases, especially in connection with the repository, probabilities are so low or so difficult to quantify that a probabilistic risk assessment is not meaningful.

56311 (NKA/AO—(81)5Pt.3) Enlarged Nordic Cooperative program on nuclear safety. Nordic study on reactor wastes: Technical Part III. Product characteristics. (SEE CODE- 4700200 Nordic Liaison Committee for Atomic Energy, Risoe (Denmark)). Aug 1981. 83p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82903429.

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Radwaste product characteristics are needed to furnish input data for safety analysis. Much work has been done on cementized and bituminized wastes but not on ion exchange resins. Joint Nordic studies on compatibility of cement and bitumen with resins and on adapting cements and bitumen processes for spent resins have been begun. This report discusses laboratory test methods, labotatrory studies on effects of process variables, correlation between laboratory tests and full-scale characteristics, and relevant tests for relevant product properties. Higher waste loadings are covered. (DLC)

56312 (NUREG/CR—1963-V1) System analysis of shallow land burial. Volume 1: code manual. Technical report, 26 September 1979-23 January 1981. Lester, D.; Buckley, D.; Donelson, S.; Dura, V.; Hecht, M. (Science Applications, Inc., La Jolla, CA (USA)). Mar 1981. 126p. NTIS, PC A07/MF A01.

A systems model for shallow land burial of low-level waste was assembled from existing models available in the nuclear industry. The model covers waste packaging, transportation, burial, and post burial activities. Subprograms were developed for unsaturated zone seepage, aquifer transport, wind erosion, and atmospheric transport. Release via available pathways are converted to population dose commitments using standard regulatory guide and ICRP Techniques. The system model starts with an initiating event selected from a list of scenarios from an event Tree Analysis Pathway Sequence, inventory, and release fraction for each scenario are available within a standard data base. The executive program which executes the system model calls subroutine in proper sequence and provides for the analysis of several hundred accident and scenario possibilities.

56313 (NUREG/CR—1963-V3) System analysis of shallow land burial. Volume 3: appendix. Technical report, 26 September 1979-23 January 1981. Lester, D.; Buckley, D.; Donelson, S.; Dura, V.; Hecht, M. (Science Applications, Inc., La Jolla, CA (USA)). Mar 1981. 229p. (SAI—013-80-652-LJ-VOL-3). NTIS, PC A11/MF A01.

This appendix is Volume 3 of a three volume report on the Systems Analysis of Shallow Land Burial Project and contains the complete data base.

56314 (NUREG/CR—1963-V3) System analysis of shallow land burial. Volume 3: appendix. Technical report 26 Sep 79-23 Jan 81. Lester, D.; Buckley, D.; Donelson, S.; Dura, V.; Hecht, M. (Science Applications, Inc., La Jolla, CA (USA)). Mar 1981. 252p. (SAI—013-80-652-LJ-VOL-3). NTIS, PC A12/MF A01.

This appendix is Volume 3 of a three volume report on the Systems Analysis of Shallow Land Burial Project and contains the complete data base.

56315 (NUREG/CR—2340) A handbook for the determination of radon attenuation through cover materials. Rogers, V.C.; Nielson, K.K. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Dec 1981. 80p. (PNL—4084). NTIS, PC A05/MF A01.

Radon emissions from bare and covered uranium mill tailings can be estimated by diffusion theory if appropriate diffusion coefficients are known. The mathematical basis for the diffusion theory expressions are herein presented, as is a general survey of previous and present research, as well as technological developments associated with randon transport through tailing cover systems. Research is presently being conducted to define more clearly the influences of moisture, porosity, pore size distribution and other factors, on the attenuative properties of cover materials. The results of these present investigations will be incorporated in a subsequent addendum to this handbook. The radon fluxes or cover thicknesses can be calculated by hand or by available computer programs. The equations and procedure for the hand calculations is in direct support of the methodology contained in Appendix P of the Generic Environmental Impact Statement on Uranium Milling. Several examples are given to demonstrate the methodology.

56316 (NUREG/CR—2782) Summary of repository siting models. Final report. Thomas, S.D.; Ross, B.; Mercer, J.W. (Teknekron Research, Inc., Bethesda, MD (USA); Gilbert/Commonwealth, Reading, PA (USA)). Jul 1982. 242p. GPO $7.50.

This report is the first in a series of reports that will provide critical reviews and summaries of computer programs that can be used to analyze the potential performance of a high-level radioactive waste repository. The computer programs identified address the following phenomena: saturated and unsaturated subsurface flow, heat transport, solute transport, surface water runoff, geomechanical interactions, and geochemical interactions. The report identifies 183 computer programs that can be used to analyze a repository site and provides a summary description of 31 computer programs. The summary descriptions can be used: to assist in code evaluation, to facilitate code comparison, to determine applicability of codes to specific problems, to identify code deficiencies, and to provide a screening mechanism for code selection.

56317 (NUS—3624) Virginia State Briefing Book for low-level radioactive-waste management. (EG and G Idaho, Inc., Idaho Falls (USA); NUS Corp., Rockville, MD (USA)). Nov 1980. Contract AC07-76ID01570. 140p. NTIS (US Sales Only). Order Number DE82020713.

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The Virginia State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. The report contains a profile of low-level radioactive waste generators in Virginia. The profile is the result of a survey of NRC licensees in Virginia. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Virginia.

56318 (NUS—3634) Illinois State Briefing Book for low-level radioactive waste management. (EG and G Idaho, Inc., Idaho Falls (USA); NUS Corp., Rockville, MD (USA)). Nov 1980. Contract AC07-76ID01570. 182p. NTIS, PC A09/MF A01. Order Number DE82020711.

Portions of document are illegible.

The Illinois State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. The report contains a profile of low-level radioactive waste generators in Illinois. The profile is the result of a survey of NRC licensees in Illinois. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Illinois.

56319 **(NUS—3635A) Idaho State Briefing Book for low-level radioactive-waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); NUS Corp., Rockville, MD (USA)). Dec 1980. Contract AC07-76ID01570. 120p. NTIS, PC A06/MF A01. Order Number DE82020707.

Portions of document are illegible.

The Idaho State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. The report contains a profile of low-level radioactive waste generators in Idaho. The profile is the result of a survey of NRC licensees in Idaho. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Idaho.

56320 **(ORNL/TM—7316) FECWATER: user's manual of a Finite-Element Code for simulating WATER flow through saturated-unsaturated porous media.** Yeh, G.T.; Strand, R.H. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 242p. NTIS, PC A11/MF A01. Order Number DE82020458.

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This report presents the user's manual of FECWATER, a Finite-Element code for simulating WATER flow through saturated-unsaturated porous media. The code is designed for generic application. For each site-specific application, 14 cards are required to specify the size of arrays and 6 cards are used to assign the control numbers in the main program. In addition, user's supply functions must be given to specify the soil property relationships between moisture content, water capacity, and hydraulic conductivity and pressure head, if they are not given in tabular form. Input data to the code includes the program control indices, properties of the porous media, the geometry in the form of elements and nodes, boundary and initial conditions, and rainfall information. Principal output includes the spatial distribution of pressure head, total head, moisture-content, and Darcy's velocity components at any desired time. Fluxes through various types of boundaries are output. In addition, diagnostic variables, such as the number of non-convergent nodes, residuals, and rainfall-seepage nodes, may be printed, if required. This user's manual should be used in conjunction with references listed in the bibliography.

56321 **(PB—82-176744) Review of some formal methods for decision-making.** Watson, S.R.; Hayward, G.M. (Cambridge Univ. (UK). Dept. of Engineering). 1981. 35p. NTIS, PC A03/MF A01.

This report reviews some of the formal approaches to decision-making which might be useful in the management of radioactive wastes. The suitability of three formal approaches to decision-making are investigated--cost benefit analysis, outranking methods and decision analysis. Each technique is described and the advantages and limitations are discussed. Finally, advantages and limitations of the techniques are related to the requirements listed above.

56322 **(PB—82-185182) Considerations of environmental protection criteria for radioactive waste. Background report.** (Office of Radiation Programs, Washington, DC (USA)). Feb 1978. 67p. NTIS, PC A04/MF A01.

Although most waste materials contain some radioactivity, their designation as radioactive waste in dependent on their having no perceived value, their origin, and whether the materials pose undesirable exposure circumstances. This document develops the considerations for and initial formulations of environmental protection criteria for radioactive wastes.

56323 **(PNCT—841-81-01) SPIDER: a computer code for superposition of Gaussian plume for the intermittent and time-dependent atmospheric release of radioactivity.** Kitahara, Y.; Narita, O.; Asano, T.; Tatsukuchi, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Jan 1981. 101p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82702217.

Annual concentration and dose of the radioactive materials normally released from the Tokai Fuel Reprocessing Plant are evaluated by a convolution method in the cross-wind direction sections using metheorological annual mean data. A computer code SPIDER is available for estimating annual concentration and cloud gamma dose by meteorological data of any averaging time and several convoluted sections in cross-wind direction. The procedure has been formulated for a computer program and the usage is explained in this report.

56324 **(PNL-SA—10261) Waste vitrification: a historical perspective.** McElroy, J.L.; Bjorklund, W.J.; Bonner, W.F. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1982. Contract AC06-76RL01830. 15p. (CONF-820424—21). NTIS (US Sales Only). Order Number DE82014847.

From ANS topical meeting on treatment and handling of radioactive wastes; Richland, WA, USA (19 Apr 1982).

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The possibility of converting high-level wastes (HLW) to glass was first pursued in Canada and England at a time when other countries were evaluating many other alternatives. By 1966, the British had completed radioactive demonstrations of the FINGAL pot process, converting HLW to borosilicate glass. By this time other countries, including France and the United States, had begun using the glass waste form. Beginning in 1966, several processes, including phosphate and borosilicate glass, were demonstrated by the US in the Waste Solidification Engineering Prototypes (WSEP) program at the Pacific Northwest Laboratory (PNL). Most of the current vitrification processes are adaptations of the FINGAL pot process or the continuous metallic melter used in the WSEP program. One notable exception is the joule-heated ceramic melter, which was adapted from commercial glass technology for HLW by PNL in the mid-1970's. Both batch and continuous processes have been developed to an advanced stage of readiness. These processes are described and compared in this paper.

56325 **(PNL-SA—10269) Feasibility of incinerating and vitrifying organic resins in a single step.** Buelt, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 14p. (CONF-820424—22). NTIS (US Sales Only). Order Number DE82014856.

From ANS topical meeting on treatment and handling of radioactive wastes; Richland, WA, USA (19 Apr 1982).

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Pacific Northwest Laboratory has completed a feasibility testing program for a process designed to incinerate and vitrify the inorganic and radionuclide components of EPICOR II resins in a single step. The process tests utilized pilot-scale, high-level waste vitrification equipment with a special feeding technique that forces contact of the combustible resins with molten glass. This technique demonstrated high retention of nonradioactive forms of cesium and strontium in the glass product. Other performance evaluations of the process were also favorable.

56326 **(PNL-SA—10303) Solubility limits of metal ions and mechanism of leaching nuclear-waste glasses.** Grambow, B. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1982. Contract AC06-76RL01830. 19p. NTIS (US Sales Only). Order Number DE82014851.

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A number of studies have qualitatively considered solubility limits to be important in the leaching of nuclear waste forms with respect to reaction layer formation and the prediction of long-term behavior under accidental conditions in a repository. These considerations are quantified in this paper by the application of data from soil chemistry to the conditions of leach tests with PNL 76-68 glass. The conclusions of this study are: (1) leaching mechanism for PNL 76-68 glass involves congruent matrix dissolution and formation of insoluble reaction products; (2) the solubility of the reaction products is similar to $Fe(OH)_3$, $Zn(OH)_2$, $Nd(OH)_3$, $SrCO_3$, $CaCO_3$ or β-$CaSiO_3$; and (3) the conditions for layer formation and the composition can be predicted.

56327 **(PNL-SA—10310) Decision making model for the recovery of useful material resources from wastes.** Rising, K.H.; Jensen, G.A.; FitzPatrick, V.F. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 14p. (CONF-8206103—1). NTIS, PC A02/MF A01. Order Number DE82019204.

From 4. international conference on international energy issues; Cambridge, UK (28 Jun 1982).

In the United States, many of the material resources necessary for energy production are imported. Strategic stockpiling of these resources has been a well-known method for reducing the economic and productivity impact of supply interruption in case of emergency. Another viable option is the recovery of valuable materials and recycle of useful products from wastes generated in energy production and industrial processing. The technical feasibility for recovery and recycle, including decontamination of nuclear-related materials, has been proven and demonstrated. The economic feasibility would depend on both the resale and strategic values of the material, the saving from reusing rather than disposing of the material, the reclamation cost, and other factors that may influence the incentive for recovery and recycle. The purpose of the work presented in this paper is to develop a model to identify the economic and other incentives for the reclamation of useful material resources. Using available data to quantify factors such as strategic and resale values, reclamation cost and disposal cost saving, this model calculates the incentive value consisting of the above factors and selects the appropriate reclamation option. Because this model is empirical, there are limitations to its application. However, within the boundary where the model has been tested, it can be a useful tool for the decision maker to evaluate the economic feasibility of reclamation.

56328 **(PNL-SA—10365) Waste glasses: requirements and characteristics.** Mendel, J.E. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1982. Contract AC06-76RL01830. 16p. (CONF-820424—23). NTIS, PC A02/MF A01. Order Number DE82014855.

From ANS topical meeting on treatment and handling of radioactive wastes; Richland, WA, USA (19 Apr 1982).

The regulatory requirements relating to waste glass that have been presented recently in draft form by the US Environmental Protection Agency and Nuclear Regulatory Commission are reviewed. These requirements assume that waste glass will be considered as a subcomponent of a waste package. Current waste package concepts are described and the important characteristics of waste glass are summarized, with emphasis on the present status of standardizing methods for measuring the characteristics of waste glass.

56329 **(PNL-SA—10536) Krypton-85 storage in sputter-deposited amorphous metals.** Tingey, G.L.; McClanahan, E.D.; Lytle, J.M.; Gordon, N.R.; Knoll, R.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 18p. (CONF-8206104—1). NTIS, PC A02/MF A01. Order Number DE82019206.

From CEC specialists meeting - methods of krypton-85 management; Brussels, Belgium (29 Jun 1982).

After comparing options for storing radioactive krypton gas, the United States Department of Energy selected ion implantation of the gas into a sputter-deposited metal matrix as the reference process. This technique is being developed with pilot-scale testing and further characterization of the deposited product. The process involves implanting krypton atoms into a growing deposit during the sputtering process. An amorphous metal deposit of nominal composition $Ni_{0\ 81}La_{0\ 09}Kr_{0\ 10}$ has been selected for further studies because of the high krypton loading, high sputtering yield, relatively low cost of the metallic components, resistance to corrosion, and stability of the product. The krypton release from this amorphous metal is described as an activated diffusion process which increases linearly with the square root of time. Studies of krypton release rate as a function of temperature were completed and an activation energy for the diffusion of 70 kcal/mole obtained. From these data, we estimated that the krypton release during the first ten years would be 0.5% for a maximum temperature of 350°C. The actual release of the krypton during storage was projected to be lower by a factor of 10^7 with the maximum temperature only 220°C. Thermal analysis studies show two energy releases occurring with krypton-containing alloys: one associated with recrystallization of the amorphous alloy and a second associated with krypton release. The total energy release between 100 and 800°C was less than 50 cal/g. Estimates are given for the cost of operation of the ion implantation process for solidification of the krypton-85 from a 2000-tonne heavy metal/year reprocessing plant. The present value costs, in 1981 dollars including capital and operating costs and assuming a 30-year life, are about $26M for the lifetime of the plant. Annual energy consumption of the process was estimated to be 3.9 M kWh/year.

56330 **(RHO-BWI-C—105) Geochemical behavior of supercalcine waste form: its stability in a basalt environment.** Holloway, J.R.; Jenkins, D.M.; Kacoyannakis, J.F.; Apted, M.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jun 1981. Contract AC06-77RL01030. 43p. NTIS, PC A03/MF A01. Order Number DE82006849.

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This report presents the initial results of the quantitative phase of the hydrothermal testing program on the geochemical behavior of waste forms. Two investigations involving supercalcine have been performed and the results are recorded in this report. One experiment involves the interaction of supercalcine with groundwater while the second involves the interaction of a mixture of supercalcine plus basalt with groundwater. Both experiments have been carried out under the maximum conditions anticipated in the repository, namely 300°C and 300 bars (30 MPa). Many unanswered questions remain, concerning the speciation of cations in solution, the full characterization of phases formed, and the prevailing Eh-pH conditions of reacted groundwater. Preliminary data have been obtained on the cations that were readily leached from unsintered supercalcine (SPC-4) and the general solubility properties of the groundwater buffered by SPC-4 +- basalt. In particular, it is observed that Si, Na, Mo, Rb, and Cr are readily leached from SPC-4 in the absence of basalt, and all of these except Cr are leached in the presence of basalt. Groundwater buffered by SPC-4 alone is thought to have in situ pH and Eh conditions of ~ 9.5 +- 0.5 and 0.0 to -0.4 V, respectively. Four secondary phases have been identified with some degree of certainty: pollucite $[(Cs,Na)AlSi_2O_6.xH_2O]$, ulvospinel (Fe_2TiO_4), α-$RuCl_3$, and $(Sr,Ca)MoO_4$. Phases have not been identified to house the insoluble elements Zr, U, P, or Ba as well as the elements whose concentrations <0.2 wt % of the oxide. Finally, it is pointed out that further attention must be directed to the elements that have radionuclides of high biological danger, even if they do not seem dangerous from the aspect of their low thermal output.

56331 **(RHO-BWI-SA—133) Preliminary assessment of the rate of deformation in the Pasco Basin, south-central Washington.** Caggiano, J.A. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Apr 1981. Contract AC06-77RL01030. 8p. NTIS, PC A02/MF A01. Order Number DE82009849.

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Preliminary results of integrating geologic, geodetic, and seismologic data are encouraging and support an average, slow rate of deformation under north-south compression since the Miocene (Caggiano and others, 1980). Data currently come from uplift rates of basalt in the Miocene and from monitoring contemporary processes. More information is needed on rates during the Pliocene and Quaternary, but acquisition of information will require additional time stratigraphic control which is currently being developed. Additional trilateration arrays are being established across mapped faults to determine whether slip is occurring, and if so, at what rate. Digital recording is being implemented for locally deployed seismometers so that the areas of rupture (seismic moment) and state of stress *(stress drop) can be determined for earthquakes that occur in basalt. Preliminary results indicate that deformation has occurred very slowly and may be expected to continue at a very slow rate. Such results currently indicate that the Hanford area of the Columbia Plateau appears to satisfy the criterion for tectonic stability.

56332 **(RHO-LD—175) Technique for determining radionuclide distribution coefficients at field moisture contents.** Smith, R.M.; Delegard, C.H. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jul 1982. Contract AC06-77RL01030. 32p. NTIS, PC A03/MF A01. Order Number DE82020391.

Past and current practices of disposing of low-level radioactive liquid wastes to the ground have necessitated the understanding of waste-sediment interactions. The sorption parameter commonly used in waste-sediment studies is the distribution coefficient (K/sub d/). This report presents a proposed method for evaluating radionuclide K/sub d/ values on sediment samples contaminated under disposal conditions and at field moisture contents. A comparison of the proposed membrane extraction technique and the commonly used centrifuge extraction technique is reported.

56333 **(RISO-I—63) Corrosion aspects of high-level waste disposal in salt domes.** Roerbo, K. (Risoe National Lab., Roskilde (Denmark)). Dec 1979. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82701848.

In the ELSAM/ELKRAT waste management project it is planned that the high-level waste is glassified, encapsuled in canisters and finally deposited in a deep hole drilled in a salt dome. In the present report corrosion aspects of the canisters after deposition are discussed. The chemical environment will probably be a limited amount of brine coming from brine inclusions in the surrounding salt and moving up against the temperature gradient, the temperature at the canister surface being in the range of 100 to 150°C. The possible types of corrosion and the expected corrosion rates for a number of potential canister materials (mild steel, austenitic and ferritic stainless steels, Ni-base alloys, copper, titanium and a few combinations of materials) are discussed. Mild steel (possibly combined with an inner layer of copper or titanium) might possibly be an appropriate choice of material for the canister.

56334 **(SAI—774-AK) Alaska State Briefing Book for low-level radioactive waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); Science Applications, Inc., Idaho Falls, ID (USA)). Aug 1981. Contract AC07-76ID01570. 144p. NTIS, PC A07/MF A01. Order Number DE82020709.

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The Alaska State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste generators in Alaska. The profile is the result of a survey of NRC licensees in Alaska. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Alaska.

56335 **(SAI—774-HI) Hawaii State briefing book for low-level radioactive waste management.** (EG and G Idaho, Inc., Idaho Falls (USA); Science Applications, Inc., Idaho Falls, ID (USA)). Jul 1981. Contract AC07-76ID01570. 124p. NTIS (US Sales Only). Order Number DE82020710.

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The Hawaii State Briefing Book is one of a series of state briefing books on low-level radioactive waste management practices. It has been prepared to assist state and federal agency officials in planning for safe low-level radioactive waste disposal. The report contains a profile of low-level radioactive waste generators in Hawaii. The profile is the result of a survey of NRC licensees in Hawaii. The briefing book also contains a comprehensive assessment of low-level radioactive waste management issues and concerns as defined by all major interested parties including industry, government, the media, and interest groups. The assessment was developed through personal communications with representatives of interested parties, and through a review of media sources. Lastly, the briefing book provides demographic and socioeconomic data and a discussion of relevant government agencies and activities, all of which may impact waste management practices in Hawaii.

56336 **(SKBF-KBS-TR—81-09) Borehole sealing with highly compactd Na bentonite.** Pusch, R. (Kaernbraenslesaekerhet, Stockholm (Sweden)). Dec 1981. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702208.

This report describes the use of highly compacted Na bentonite for borehole plugging. Bentonites have an extremely low permeability and a low diffusivity, and a swelling ability which produces a nonleaching boundary between clay and rock if the initial bulk density of the bentonite is sufficiently high. The suggested technique, which is applicable to long vertical, and inclined, as well as horizontal boreholes, is based on the use of perforated copper pipes to insert elements of compacted bentonite. Such pipe segments are connected at the rock surface and successively inserted in the hole. When the hole is equipped, the clay takes up water spontaneously and swells through the perforation, and ultimately forms an almost completely homogenous clay core. It embeds the pipe which is left in the hole. Several tests were conducted in the laboratory and one field test was run in Stripa. They all showed that a gel soon fills the slot between the pipe and the confinement which had the form of metal pipes in the laboratory investigations. Subsequently, more clay migrates through the perforation and produces a stiff clay filling in the slot. The redistribution of minerals, leading ultimately to a high degree of homogeneity, can be described as a diffusion process. The rate of redistribution depends on the joint geometry and water flow pattern in the rock. In the rock with an average joint frequence of one per meter or higher, very good homogeneity and sealing ability of the clay are expected within a few months after the application of the plug.

56337 **(UCRL—87091) Nuclear-waste-package program for high-level isolation in Nevada tuff.** Rothman, A.J. (Lawrence Livermore National Lab., CA (USA)). Jan 1982. Contract W-7405-ENG-48. 5p. (CONF-820609—75). NTIS, PC A02/MF A01. Order Number DE82020173.

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

The objective of the waste package program is to insure that a package is designed suitable for a repository in tuff that meets performance requirements of the NRC. In brief, the current (draft) regulation requires that the radionuclides be contained in the engineered system for 1000 years, and that, thereafter, no more than one part in 10^5 of the nuclides per year leave the boundary of the system. Studies completed as of this writing are thermal modeling of waste packages in a tuff repository and analysis of sodium bentonite as a potential backfill material. Both studies will be presented. Thermal calculations coupled with analysis of the geochemical literature on bentonite indicate that extensive chemical and physical alteration of bentonite would result at the high power densities proposed (ca. 2 kW/package and an area density of 25 W/m^2), in part due to compacted bentonite's relatively low thermal conductivity when dehydrated (~ 0.6 +- 0.2 W/m°C). Because our groundwater contains K^+, an upper hydrothermal temperature limit appears to be 120 to 150°C. At much lower power densities (less than 1 kW per package and an areal density of 12 W/m^2), bentonite may be suitable.

56338 **Canister arrangement for storing radioactive waste.** Lorenzo, D.K.; Van Cleve, J.E. Jr. (to Department Of Energy). US Patent 4,328,423. 4 May 1982. Filed date 23 Apr 1980. vp.

PAT-APPL-143060.

The subject invention relates to a canister arrangement for jointly storing high level radioactive chemical waste and metallic waste resulting from the reprocessing of nuclear reactor fuel elements. A cylindrical steel canister is provided with an elongated centrally disposed billet of the metallic waste and the chemical waste in vitreous form is disposed in the annulus surrounding the billet.

56339 **Vitrification of nuclear waste with low heat generation.** Tennant, M.H.; Murphree, B.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). *Nuclear Engineering and Design;* **67**: No. 3, 415-423(Feb 1982).

Analyses of thermal processes in the glass melter and storage container are given for vitrification of defense waste.

56340 **Fracturing of simulated high-level waste glass in canisters.** Peters, R.D.; Slate, S.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Nuclear Engineering and Design;* **67**: No. 3, 425-445(Feb 1982).

Waste-glass castings generated from engineering-scale developmental processes at the Pacific Northwest Laboratory are generally found to have significant levels of cracks. This report discusses the causes and extent of fracturing in full-scale canisters of waste glass as a result of cooling and accidental impact.

56341 **Monitoring an underground repository with modern seismological methods.** Majer, E.L.; McEvilly, T.V.; Kings, M.S. (Univ of Calif, Berkeley). *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts;* **18**: No. 6, 517-527(Dec 1981).

An experiment utilizing microearthquake and acoustic emission techniques has been designed to investigate the discrete failure and behavior of hard rock in response to storage of high level nuclear waste. Data are presently being collected from a 15-station, three-dimensional array of piezoelectric sensors surrounding 11 canisters of spent nuclear fuel and 6 electrically heated simulator canisters. The canisters are arranged in a linear array 420 m beneath the surface in the Climax Stock at the Nevada Test Site. The velocity and attenuation characteristics within the array imply that the rock is not homogeneous at the observed frequencies. The basis for the experiment's concept, the instrumentation emplaced, and preliminary results of the monitoring program are reviewed. 22 refs.

56342 **Ground-water hydrology around salt domes in the East Texas Basin: a practical approach to the contaminant transport problem.** Fogg, G.E.; Kreitler, C.W. (Univ of Tex, Austin). *Bulletin of the Association of Engineering Geologists;* **18**: No. 4, 387-411(Nov 1981).

Salt domes in the East Texas Basin are being studied as potential sites for deep burial of nuclear wastes. 44 refs.

56343 **Retreat of the Caprock Escarpment and denudation of the Rolling Plains in the Texas panhandle.** Gustavson, T.C.; Finley, R.J.; Baumgardner, R.W. Jr. (Univ of Tex, Austin). *Bulletin of the Association of Engineering Geologists;* **18**: No. 4, 413-422(Nov 1981).

The feasibility of using Permian bedded salts in the Palo Duro Basin of the Texas Panhandle for nuclear waste disposal is in part dependent on maintaining the integrity of the repository throughout a geologically significant length of time, possibly as long as 250,000 years. Geologic processes such as, scarp retreat erosion, and denudation decrease the thickness of protective overburden above an underground repository. The bedded salts beneath the Southern High Plains, where they are adjacent to the Caprock Escarpment, may eventually be affected by erosional processes as the Caprock Escarpment retreats westward and as the Rolling Plains are denuded. 25 refs.

56344 **Technical developments in the WIPP program.** Weart, W.D. (Sandia Lab, Albuquerque, NM). *Bulletin of the Association of Engineering Geologists;* **18**: No. 4, 423-436(Nov 1981).

Five years of study has led to the conclusion that radioactive wastes can be safety isolated in the bedded salt of the Delaware Basin in southeast New Mexico. The following aspects have been evaluated, and they are considered not to pose serious future hazards: site integrity (dissolution and deformation of the salt); hydrology; deposits of potash and hydrocarbons that may attract future exploitation; interactions between the waste and the hot rock; brine migration; canister corrosion; room closure rates; and natural failure scenarios. 29 refs.

56345 **Geologic nuclear waste repository site selection studies in the Paradox Basin, Utah.** Rogers, T.H.; Conwell, F.R. (Woodward-Clyde Consult, San Francisco, Calif). *Bulletin of the Association of Engineering Geologists;* **18**: No. 4, 437-443(Nov 1981).

During Phase I regional-level studies, a literature review was conducted to ascertain geologic characteristics pertinent to repository siting factors. On the basis of the regional screening results, four areas in southeastern Utah were selected as being suitable for more detailed study in Phase II: Elk Ridge and Gibson Dome, containing nearly horizontal bedded salt deposits; Salt Valley, containing a diapiric salt anticline; and Lisbon Valley, containing a nondiapiric salt anticline. During current Phase II area studies, the four study areas are being characterized in greater detail than in Phase I. Phase II will culminate in the identification of a potentially suitable location(s), if any, that will be recommended for study in still greater detail in a subsequent phase of work. 5 refs.

56346 **Migration of gas-liquid inclusions in single crystals of potassium and sodium chlorides.** Olander, D.R.; Machiels, A.J.; Muchowski, E. (Univ of Calif, Berkeley). *Nuclear Science and Engineering;* **79**: No. 2, 212-227(Oct 1981).

Natural salt deposits contain small brine inclusions that can be set into motion by a temperature gradient arising from storage of nuclear wastes in the salt. The mechanism of thermal gradient migration of gas-liquid inclusions is analyzed and discussed in this paper. The object of the analysis is to determine the velocity of the two-phase fluid inclusion in the thermal gradient imposed on the solid salt. 17 refs.

56347 **Gas generation from organic transuranic wastes - 1. alpha radiolysis at atmospheric pressure.** Kosiewicz, S.T. (Los Alamos Natl Lab, NM, USA). *Nuclear Technology;* **54**: No. 1, 92-99(Jul 1981).

Gas generation from the alpha radiolysis of organic, transuranic (TRU) wastes has been cited as a potential area of concern for their terminal isolation in a geologic repository. This paper discusses gas generation rates from the alpha radiolysis of typical organic transuranic wastes, which are affected by the organic matrix, dose rate, dose, and temperature. The matrices under test were cellulosics, plastics, and rubber materials. 23 refs.

56348 **Hanford site sorption studies for the control of radioactive wastes: a review.** Routson, R.C.; Barney, G.S.; Smith, R.M. (Rockwell Hanford Oper, Richland, Wash, USA). *Nuclear Technology;* **54**: No. 1, 100-106(Jul 1981).

Past sorption studies evolved with time from generic, to waste specific, to empirical waste-specific/site-specific studies are presented. This paper discusses current sorption studies, which are site specific and based on a radionuclide transport soil properties model (PERCOL). Radionuclide sorption is treated in the model PERCOL by the use of laboratory developed empirical/statistical equations that predict sorption as a function of groundwater chemistry. 24 refs.

56349 **Properties of plutonium(iv) polymer of environmental importance.** Rai, D.; Swanson, J.L. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *Nuclear Technology;* **54**: No. 1, 107-112(Jul 1981).

The stability of Pu(IV) polymer suspensions, the solubility of the polymer, and the nature of the soluble plutonium species were studied from pH 3 to 7 in dilute chloride and in dilute nitrate solutions. Previous work on the polymer did not address such environmentally important properties as the concentration of soluble plutonium present along with the polymer, the nature of the solute species, and the stability of polymer suspensions at near-neutral pH values. This study was undertaken to answer these questions. 15 refs.

56350 Chemical processing facilities for partitioning actinides from nuclear fuel cycle waste mixtures. Tedder, D.W.; Finney, B.C.; Blomeke, J.O. (Ga Inst of Technol, Atlanta, USA). *Nuclear Technology;* **53**: No. 1, 19-29(Apr 1981).

This paper discusses the U.S. Department of Energy Actinide Partitioning Program, which led to the conceptual design of highly integrated chemical processing facilities to achieve the required levels of actinide element partitioning from all fuel cycle wastes. These facilities utilize both conventional tributyl phosphate extraction cycles and several new extractants such as a carbamylmethylene phosphonate (bidentate) and 2-ethylhexyl alcohol. The consequences for a light water reactor fuel cycle that result from operating these partitioning facilities include increased volumes of low- and medium-level wastes and significantly increased capital investment requirements and operating costs. 18 refs.

56351 Calculation of groundwater buoyancy effects near nuclear waste repositories. Keeton, J.M.; Rickertsen, L.D.; Williams, R.F. (SAI Oak Ridge, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **39**: 149-150(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56352 Prediction of centrifugal pump cleaning ability in waste sludge. Churnetski, B.V. (SRL, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **39**: 165-166(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56353 Small-scale processing of actual Savannah River high-level waste. Lee, L.M.; Papouchado, L.M.; Woolsey, G.B. (SRL, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **39**: 171(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56354 Recent developments in defense waste vitrification. Bjorklund, W.J. (PNL, Richland, WA 99352). *Transactions of the American Nuclear Society;* **39**: 173-174(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56355 Radiological risks for the alternatives for the long-term management of high-level wastes at West Valley. Peterson, J.M.; Rodger, W.A.; Yuan, Y.C. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **39**: 179-180(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56356 Operational and regulatory impacts of regional management on transportation of commercial low-level radioactive waste. Shepherd, E.W.; Shirley, C.G.; Wilmont, E.L. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **39**: 207-208(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56357 Regional waste treatment with underground monolith disposal for low-heat wastes. Forsberg, C. (ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **39**: 208-209(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56358 High integrity container design requirements for TMI low-level waste. Vigil, M.G. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **39**: 211-212(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56359 Management of contaminated scrap metal waste streams. Mack, J.E.; Williams, L.C. (ORNL, Oak Ridge, TN 27830). *Transactions of the American Nuclear Society;* **39**: 212-214(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56360 The national long-term high-level waste technology program. Gray, P.L. (SRL, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **39**: 224-225(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56361 Technology for long-term management of ICPP Defense Waste. Berreth, J.R. (Exxon Nuclear Idaho, Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **39**: 225-226(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56362 Solidification of Savannah River plant high-level waste. Kelley, J.A.; Maher, R.; Shafranek, L.F.; Zeyfang, R.W. (SRL, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **39**: 228(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56363 Development of standard testing methods for nuclear waste forms. Nelson, R.D. (PNL, Richland, WA 99352). *Transactions of the American Nuclear Society;* **39**: 228-229(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56364 Use of coreless induction melting for transuranic waste processing. Benedetti, R.L.; Gibson, G.W.; McCall, J.L.; Tenaglia, R.D. (EG&G Idaho, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **39**: 229-231(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56365 High-level waste solidification system for the Western New York State Service Center. Holton, L.K.; Siemens, D.H. (PNL, Richland, WA 99352). *Transactions of the American Nuclear Society;* **38**: 715-716(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

56366 Rock mechanics in the National Waste Terminal Storage Program. Monsees, J.E.; Wigley, M.R. (Battelle, Meml Inst, Columbus, OH). *Proceedings of the Symposium on Waste Management;* **2**: 1095-1107(1981). (CONF-810217—).

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

The paper summarizes rock mechanics research being conducted as part of the National Waste Terminal Storage (NWTS) Program. The research includes theoretical, laboratory, and field investigations to determine the rock properties and develop and calibrate the analytical models required to predict the rock behavior for design studies, long-range predictions, and performance assessments of the repositories. The immediate objective of this rock mechanics research is to provide the technology required to produce a credible conceptual design for repositories in several rock types by 1985.

56367 Waste Management '81: ANS topical meeting, the state of waste isolation in the US and elsewhere, advocacy programs and public communications, proceedings of the symposium on waste management, 1981. Post, R.G. (ed.). (Univ of Ariz, Dep of Nucl Eng, Tucson, USA). *Proceedings of the Symposium on Waste Management;* vp(1981).

The two volumes contain 90 papers presented at the meeting, 61 of which are indexed separately. The papers are grouped under general topics that include programmatic and regulatory issues, international approaches to waste management, alternate waste forms, transportation of radioactive wastes, waste isolation, low-level waste, volume reduction and solidification, mill tailings and decommissioning of nuclear facilities, and others.

56368 **Incineration/vitrification of simulated low-level institutional wastes in a joule-heated glass melter.** Buelt, J.L.; Oma, K.H. (Battelle, Pac Northwest Lab, Richland, Wash). *Nuclear and Chemical Waste Management;* **2**: No. 3, 175-182(1981).

The purpose of this study was to determine the feasibility of reducing the volume of low-level institutional wastes by incineration and then converting the residual solids into glass with a single-step process. Experimental test results with simulated waste show that a joule-heated ceramic melter originally developed for high-level waste vitrification can be used for the low-level waste volume reduction process. Off-gas analysis from the experiment shows that incineration of combustible solids was essentially complete. This is attributable to high combustion temperatures (>950/degree/C) and the introduction of excess combustion air or oxygen at the melter's glass surface. Results of the incineration experiment indicate that process scale-up for higher capacities is quite feasible. Further tests aimed at adapting high-level waste vitrification technology to the management of both institutional wastes and low-level wastes generated from the nuclear fuel cycle are recommended.

56369 **Environmental biogeochemistry of chelating agents and recommendations for the disposal of chelated radioactive wastes.** Means, J.L.; Alexander, C.A. (Battelle, Columbus Lab, Ohio). *Nuclear and Chemical Waste Management;* **2**: No. 3, 183-196(1981).

The environmental chemistry of the three most common aminopolycarboxylic acid chelating agents, NTA (nitrilotriacetic acid), EDTA (ethylenediaminetetraacetic acid), and DTPA (diethylenetriaminepentaacetic acid) is reviewed. This review includes information on their persistence in the environment, as well as their tendency to form complexes with actinides. Data on the sorption of chelated actinides by geologic substrates and on the uptake of chelated actinides by plants are also presented. Three different technical options for disposing chelated low-level radioactive wastes are proposed: bind the solidified chelated waste in some kind of solid matrix that has a slow leach rate and bury the waste in a "dry" disposal site; substitute biodegradable chelating agents in the decontamination reagent for the chelating agents that are persistent in the environment; chemically or thermally degrade the chelating agents in the waste prior to disposal. The relative advantages and disadvantages of each of these options are discussed. 81 refs.

56370 **Comparison of glass and ceramic leaching behaviour by natural analogs.** Shade, J.W. (Battelle, Pac Northwest Lab, Richland, Wash). *Nuclear and Chemical Waste Management;* **2**: No. 3, 219-228(1981).

Dissolution studies of rock-forming minerals and leach studies of glass and crystalline waste forms yield similar solution composition data, but may involve different leaching mechanisms. The compositions NaAlSiO/sub 4/ (nepheline) and NaAlSi/sub 3/O/sub 8/ (albite) in both glass and crystalline form have been subjected to leaching and etch tests, then the resulting surfaces were examined by electron spectroscopy for chemical analysis (ESCA) sputter profiling and by a scanning electron microscope (SEM). The results of surface examination suggest that crystal surfaces are attacked selectively to produce a pattern of etch pits dictated by the crystal structure and without a change in surface composition. Glass surface compositions following leaching were distinctly different than the bulk. 13 refs.

56371 **Comparative study of hydrothermal stability experiments: application to simulated nuclear waste forms.** Scheetz, B.E.; Freeborn, W.P.; Komarneni, S.; Atkinson, S.D.; White, W.B. (Pa State Univ, University Park). *Nuclear and Chemical Waste Management;* **2**: No. 3, 229-236(1981).

The hydrothermal dissolution behavior of two simulated nuclear waste forms, a borosilicate glass and a tailored ceramic, was investigated by three types of high pressure apparatus: sealed gold capsules in cold seal pressure vessels, a rocking autoclave apparatus, and a fluid injection, flow-through type apparatus. Saturation of the solutions was observed in both cold seal and rocking autoclave apparatus which provide information about limiting solubilities, solid reaction products, and kinetic data near saturation. The flow-through system provides kinetic data at high undersaturations and gives the hydrothermal dissolution rates that are most comparable to leach rates determined with atmospheric pressure measurements. 15 refs.

56372 **Phantom dissolution leach model.** Richardson, G.L. (Hanford Eng Dev Lab, Richland, Wash). *Nuclear and Chemical Waste Management;* **2**: No. 3, 237-241(1981).

A simplified method for analyzing leach data from monolithic solids is proposed that treats the combined leach mechanisms as a dissolution process. With this model, the leachant is assumed to remove the leached constituents as if they were dissolved from the surface of a phantom solid that decreases in size with time as leaching proceeds. The depth of penetration of the leachant to the phantom surface at any time is given by an equation. 14 refs.

56373 **DOE's program for high-level radioactive waste disposal.** Heath, C.A. (US DOE). pp 1-17 of Atomic Industry Forum, fuel cycle conference '81, 1981. Washington, DC; Atomic Industry Forum (1981).

From Fuel cycle conference; Los Angeles, CA, USA (15 Mar 1981).

There are a number of ways in which discharged spent fuel can be handled. These are, of course, a resumption of reprocessing as originally-planned, with recycle of mixed oxides in LWR's and disposal of vitrified waste; interim storage at central facilities with eventual reprocessing for use either in LWR's or breeders; or interim storage prior to direct disposal. In the fall of 1979, there were a number of uncertainties concerning reprocessing. Consideration of the direct disposal of spent fuel as a reference case allowed a focus on the primary issues related only to waste disposal. In order to ensure that the NRC can make an appropriate rule concerning the future availability of waste disposal, it seems essential that the Department's program continue towards qualification of sites suitable for a system of large-scale regional repositories with adequate capacity to handle all the wastes that will be generated by current and future power plants within a reasonable time frame. The Nuclear Regulatory Commission has now passed into law procedural requirements for the characterization of sites leading up to an application for the construction of a full-scale waste repository. It is now required that exploratory shafts be developed and underground examination of sites take place prior to the consideration of any license application.

56374 **Low-level waste management generation to disposal.** Levin, G.B. (Edgerton, Germeshausen & Grier Inc, Idaho Falls, Idaho). pp 1-21 of Atomic Industry Forum, fuel cycle conference '81, 1981. Washington, DC; Atomic Industry Forum (1981).

From Fuel cycle conference; Los Angeles, CA, USA (15 Mar 1981).

An attempt is made to emphasize that management of low-level waste is the current critical problem facing the nuclear industry today and the potential cornerstone of a waste management system. An overview is presented of the current situation in the United States. With this as a basis, the current problems, challenges, and opportunities are defined.

56375 **U.S. nuclear waste management program.** Meyers, S. (US DOE). pp 1-16 of Atomic Industry Forum, fuel cycle conference '81, 1981. Washington, DC; Atomic Industry Forum (1981).

From Fuel cycle conference; Los Angeles, CA, USA (15 Mar 1981).

Current activity in the DOE is outlined that is addressing both the technical and institutional concern associated with the management of radioactive waste. The topics discussed are: Commercial Waste Management Program; waste systems evaluation and public interaction; waste treatment technology; West Valley Demonstration Project; Remedial Action Program; Interium Spent Fuel Management Program; and defense waste management program.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 56315, 56326, 56330, 56332, 56342, 56348, 56349, 56351, 56369, 56370, 56371, 56372, 58243, 58283

56376 (INIS-mf—7092, pp vp) **Assessment of radiation hygiene impacts of the existence and operation of the Nuclear Research Institute.** Razga, J.; Horyna, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

Methods are described of the control of environmental contamination in the area of UJV. Tables are presented showing the results of monitoring the radioactivity of water in the Vltava river upstream and downstream of the waste water discharge outlet. Measurements of the radioactivity of the atmosphere, of atmospheric fallout and of plant ash are carried out on samples taken in a radius of 5 km around UJV. The results show that the contamination of the environment which by far does not reach the set limits is not due to the UJV nuclear facilities.

56377 (NUREG—0879) **Environmental assessment for the Barnwell low-level waste disposal facility.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Waste Management). Jan 1982. 271p. NTIS, PC A12/MF A01.

This Environmental Assessment was prepared by the U.S. Nuclear Regulatory Commission in response to a request by the South Carolina Department of Health and Environmental control, Bureau of Radiological Health, for technical assistance in evaluating the impacts of the Barnwell facility. Alternatives in the following areas were considered in the assessment: (1) No action; (2) Operational procedures; (3) Financial guarantees for compliance, and (4) Methods of minimizing the potential for radionuclide release and transport over the long term. Environmental impacts were evaluated for the following actions: (1) Closing the site and implementing site closure and stabilization plans; (2) Continuing operations under current conditions, and (3) Continuing operations under altered conditions.

56378 (NUREG/CR—1636-Vol.1) **Risk methodology for geologic disposal of radioactive waste: model description and user manual for Pathways model.** Helton, J.C.; Kaestner, P.C. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 154p. (SAND—78-1711-Vol.1). NTIS, PC A08/MF A01 - GPO.

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A model for the environmental movement and human uptake of radionuclides is presented. This model is designated the Pathways-to-Man Model and was developed as part of a project funded by the Nuclear Regulatory Commission to design a methodology to assess the risk associated with the geologic disposal of high-level radioactive waste. The Pathways-to-Man Model is divided into two submodels. One of these, the Environmental Transport Model, represents the long-term distribution and accumulation of radionuclides in the environment. This model is based on a mixed-cell approach and describes radionuclide movement with a system of linear differential equations. The other, the Transport-to-Man Model, represents the movement of radionuclides from the environment to man. This model is based on concentration ratios. General descriptions of these models are provided in this report. Further, documentation is provided for the computer program which implements the Pathways Model.

56379 (NUREG/CR—1636-Vol.2) **Risk methodology for geologic disposal of radioactive waste: sensitivity analysis of the environmental transport model.** Helton, J.C.; Iman, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1980. Contract AC04-76DP00789. 224p. (SAND—79-1393-Vol.2). NTIS, PC A10/MF A01 - GPO.

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Results are presented from a sensitivity analysis study of a model developed to represent the surface movement of radionuclides. The study has two purposes: (1) to develop a capability to perform sensitivity analyses of the model; and (2) to acquire insight with respect to the variables which influence predictions made by the model. Two variations of a hypothetical river receiving a radionuclide discharge are defined. Independent variables of the following types are introduced: variables which define physical properties of the river system (e.g., soil depth, river discharge and sediment resuspension) and variables which summarize radionuclide properties (i.e., distribution coefficients). The following dependent variables are investigated: (1) radionuclide concentration in soil; (2) dissolved radionuclide concentration in surface-water; and (3) total radionuclide concentration in surface-water. The investigation employs sensitivity analysis techniques based on stepwise regression. This work constitutes part of a project at Sandia National Laboratories funded by the Nuclear Regulatory Commission to develop a methodology to assess the risk associated with geologic disposal of radioactive waste.

56380 (NUREG/CR—1636-Vol.3) **Risk methodology for geologic disposal of radioactive waste: asymptotic properties of the environmental transport model.** Helton, J.C.; Brown, J.B.; Iman, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1981. Contract AC04-76DP00789. 163p. (SAND—79-1908-Vol.3). NTIS, PC A08/MF A01 - GPO.

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The Environmental Transport Model is a compartmental model developed to represent the surface movement of radionuclides. The purpose of the present study is to investigate the asymptotic behavior of the model and to acquire insight with respect to such behavior and the variables which influence it. For four variations of a hypothetical river receiving a radionuclide discharge, the following properties are considered: predicted asymptotic values for environmental radionuclide concentrations and time required for environmental radionuclide concentrations to reach 90% of their predicted asymptotic values. Independent variables of two types are used to define each variation of the river: variables which define physical properties of the river system (e.g., soil depth, river discharge and sediment resuspension) and variables which summarize radionuclide properties (i.e., distribution coefficients). Sensitivity analysis techniques based on stepwise regression are used to determine the dominant variables influencing the behavior of the model. This work constitutes part of a project at Sandia National Laboratories funded by the Nuclear Regulatory Commission to develop a methodology to assess the risk associated with geologic disposal of radioactive waste.

56381 (NUREG/CR—1963-V1) **System analysis of shallow land burial. Volume 1: code manual. Technical report 26 Sep 79-23 Jan 81.** Lester, D.; Buckley, D.; Donelson, S.; Dura, V.; Hecht, M. (Science Applications, Inc., La Jolla, CA (USA)). Mar 1981. 126p. (SAI—013-80-652-LJ-VOL-1). NTIS, PC A07/MF A01.

A systems model for shallow land burial of low-level waste was assembled from existing models available in the nuclear industry. The model covers waste packaging, transportation, burial, and post burial activities. Subprograms were developed for unsaturated zone seepage, aquifer transport, wind erosion, and atmospheric transport. Release via available pathways are converted to population dose commitments using standard regulatory guide and ICRP Techniques. The system model starts with an initiating event selected from a list of scenarios from an event Tree Analysis Pathway Sequence, inventory, and release fraction for each scenario are available within a standard data base. The executive program which executes the system model calls subroutine in proper sequence and provides for the analysis of several hundred accident and scenario possibilities.

56382 (NUREG/CR—1963-V2) **System analysis of shallow land burial. Volume 2: technical background. Technical report, 26 November 1979-23 January 1981.** Lester, D.; Buckley, D.; Donelson, S.; Dura, V.; Hecht, M. (Science Applications, Inc., La Jolla, CA (USA)). Mar 1981. 368p. (SAI—013-80-652-LJ-VOL-2). NTIS, PC A16/MF A01.

This is volume two of a three volume set detailing the activities and results of the System Analysis of Shallow Land Burial Project. Activities under four project tasks are described: Task 1 -

Identify Potential Radionuclide Release Pathways, Task 2 - Systems Model for Shallow Land Burial of Low-Level Waste, Task 3 - Sensitivity and Optimization Study and Task 4 - Reference Facility Dose Assessment.

56383 (NUREG/CR—1963-V2) **System analysis of shallow land burial. Volume 2: technical background. Technical report 26 Sep 79-23 Jan 81.** Lester, D.; Buckley, D.; Donelson, S.; Dura, V.; Hecht, M. (Science Applications, Inc., La Jolla, CA (USA)). Mar 1981. 367p. (SAI—013-80-652-LJ-VOL-2). NTIS, PC A16/MF A01.

This is volume two of a three volume set detailing the activities and results of the System Analysis of Shallow Land Burial Project. Activities under four project tasks are described: Task 1 - Identify Potential Radionuclide Release Pathways, Task 2 - Systems Model for Shallow Land Burial of Low-Level Waste, Task 3 - Sensitivity and Optimization Study and Task 4 - Reference Facility Dose Assessment.

56384 (NUREG/CR—2407) **Radon and aerosol release from open-pit uranium mining.** Thomas, V.W.; Nielson, K.K.; Mauch, M.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1982. Contract AC06-76RL01830. 388p. (PNL—4071). NTIS, PC A17/MF A01 - GPO $9.50.

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The quantity of ^{222}Rn (hereafter called radon) released per unit of uranium produced from open pit mining has been determined. A secondary objective was to determine the nature and quantity of airborne particles resulting from mine operations. To accomplish these objectives, a comprehensive study of the release rates of radon and aerosol material to the atmosphere was made over a one-year period from April 1979 to May 1980 at the Morton Ranch Mine which was operated by United Nuclear Corporation (UNC) in partnership with Tennessee Valley Authority (TVA). The mine is now operated for TVA by Silver King Mines. Morton Ranch Mine was one of five open pit uranium mines studied in central Wyoming. Corroborative measurements were made of radon flux and ^{226}Ra (hereafter called radium) concentrations of various surfaces at three of the other mines in October 1980 and again at these three mines plus a fourth in April of 1981. Three of these mines are located in the Powder River Basin, about 80 kilometers east by northeast of Casper. One is located in the Shirley Basin, about 60 km south of Casper, and the remaining one is located in the Gas Hills, approximately 100 km west of Casper. The one-year intensive study included simultaneous measurement of several parameters: continuous measurement of atmospheric radon concentration near the ground at three locations, monthly 24-hour radon flux measurements from various surfaces, radium analyses of soil samples collected under each of the flux monitoring devices, monthly integrations of aerosols on dichotomous aerosol samplers, analysis of aerosol samplers for total dust loading, aerosol elemental and radiochemical composition, aerosol elemental composition by particle size, wind speed, wind direction, temperature, barometric pressure, and rainfall.

56385 (NUREG/CR—2675-Vol.1) **Relevance of biotic pathways to the long-term regulation of nuclear waste disposal. A report on Tasks 1 and 2 of Phase I.** McKenzie, D.H.; Cadwell, L.L.; Cushing, C.E. Jr.; Harty, R.; Kennedy, W.E. Jr.; Simmons, M.A.; Soldat, J.K.; Swartzman, B. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. 69p. (PNL—4241-Vol.1). GPO $5.00.

The purpose of the work reported here was to evaluate the relevance of biotic transport to the assessment of impacts and licensing of low-level waste disposal sites. Available computer models and their recent applications at low-level waste disposal sites are considered. Biotic transport mechanisms and processes for both terrestrial and aquatic systems are presented with examples from existing waste disposal sites. Following a proposed system for ranking radionuclides by their potential for biotic transport, recommendations for completing Phase I research are presented. To evaluate the long-term importance of biotic transport at low-level waste sites, scenarios for biotic pathways and mechanisms need to be developed. Scenarios should begin with a description of the waste form and should include a description of biotic processes and mechanisms, approximations of the magnitude of materials transported, and a linkage to processes or mechanisms in existing models. Once these scenarios are in place, existing models could be used to evaluate impacts resulting from biotic transport and to assess the relevance to site selection and licensing of low-level waste disposal sites.

56386 (WAPD-RC/E(ESE)—576) **Annual effluent and environmental monitoring report for calendar year 1981.** (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Apr 1982. Contract AC11-76PN00014. 48p. NTIS, PC A03/MF A01. Order Number DE82013958.

The results of the effluent and environmental monitoring program for 1981 at the Bettis Laboratory are presented. The results obtained from the effluent monitoring program demonstrate that the existing procedures for controlling liquid and airborne effluents ensure that all such releases during 1981 were made in accordance with applicable federal regulations. Evaluation of the effluent and environmental data indicate that the operation of the Laboratory continued to have no adverse effect on the quality of the environment. Furthermore, a conservative assessment of the radiation exposure from the small radioactivity releases from the Bettis Laboratory demonstrated that the dose estimates were too low to measure and were well below the most restrictive dose limits prescribed by the Environmental Protection Agency and the Department of Energy.

56387 **Leach testing of SYNROC and glass samples at 85 and 200/degree/C.** Oversby, V.M.; Ringwood, A.E. (Aust Natl Univ, Canberra, ACT). *Nuclear and Chemical Waste Management;* **2**: No. 3, 201-206(1981).

Leach tests were conducted on 0.5 g disc samples of SYNROC and two glass types using distilled water at 85 and 200/degree/C. No leaching was detected for SYNROC at either temperature. Thus, the upper limit on leach rate for SYNROC is <0.005 g/m/sup 2/d. Waste glass PNL 76-68 had leach rates of 1.4 g/m/sup 2/ d at 85/degree/C and 8.9 g/m/sup 2/ d at 200/degree/C, while 73-1 glass frit had a leach rate of 41 g/m/sup 2/ d at 200/degree/C. The leach tests were repeated in the presence of rock powders. Again, no leaching was measurable for SYNROC. PNL 76-68 glass had leach rates between 4 and 23 g/m/sup 2/ d at 200/degree/C and 73-1 frit leached at rates between 29 and 176 g/m/sup 2/ d at 200/degree/C. Tests were also conducted on crushed glass samples (PNL 76-68, 100-200 /mu/m size fraction). Bulk leach rates were calculated based on measurement of Ca, Cs, and U in the leach solutions. The results of the leach tests show that SYNROC is several orders of magnitude more resistant to leaching than glass.

56388 **Alpha spectrum profiling of plutonium in leached simulated high-level radioactive waste-glass.** Diamond, H.; Friedman, A.M. (Argonne Natl Lab, Ill). *Nuclear and Chemical Waste Management;* **2**: No. 3, 207-212(1981).

Low-geometry X-ray spectra from /sup 239/Pu and /sup 237/Np, incorporated into simulated high-level radioactive waste-glass, were transformed into depth distributions for these elements. Changes in the depth profiles were observed for a series of static leachings in 75/degree/C water. Radiochemical assay of the leach solutions revealed that little neptunium or plutonium was leached, and that the amount leached was independent of leaching time. The depth profiles of the leached specimens showed that there was selective leaching of nonradioactive components of the glass, concentrating the remaining neptunium and plutonium in a broad zone near (but not at) the glass surface. Eventual redeposition of nonradioactive material onto the glass surface inhibited further leaching.

56389 **Application of neutron activation analysis to leach rate studies.** Bates, J.K.; Jardine, L.J.; Flynn, K.F.; Steindler, M.J. (Argonne Natl Lab, Ill). *Nuclear and Chemical Waste Management;* **2**: No. 3, 213-218(1981).

The applicability of neutron activation analysis to the determination of element release from simulated nuclear waste forms during leaching is described for three different glasses. Potential neutron irradiation effects are discussed and shown, through a series of leach tests on activated and nonactivated glass samples, to have no discernible effect on the release of silicon and cesium during leaching. The radioisotopes best suited for analysis with this method and their associated detection limits are identified and the method's applicability to waste forms other than glass is discussed.

56390 **Remedial actions at inactive uranium mill tailings sites.** Campbell, R.H.; Matthews, M.L. (DOE, Albuquerque, NM). pp 207-223 of Uranium resource technology, Seminar 3, 1980. Morse, J.G. (ed.). Golden, CO; Colorado School of Mines Press (1980).

From 3. uranium resource technology seminar; Golden, CO, USA (10 Mar 1980).

In 1978 Congress enacted Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978. The Act authorizes DOE, in cooperation with the affected States, Indian tribes and the owners of the sites, to implement remedial action at inactive uranium mill tailings sites. Since there are significant uncertainties in the present technology for controlling the radiological hazards associated with mill tailings, a concentrated research and development program based on an integrated Remedial Action Technology Plan will be implemented with significant laboratory, university and contractor participation. Discussed are the major questions and issues concerning the measurement of radon and radon daughters, requirements for remedial action, and the main categories of research and development for the mill tailings project.

0540 Health And Safety

REFER ALSO TO CITATION(S) 56284, 56285, 56310, 56323, 56330, 56344, 56347, 56369, 56417, 58117, 58120, 58232, 58236

56391 **(NKA/AO—(81)5Pts.1and2) Enlarged Nordic cooperative program on nuclear safety. Nordic study on reactor waste: Technical Part I. Reference system; and Technical Part II. Safety analysis.** (SEE CODE- 4700200 Nordic Liaison Committee for Atomic Energy, Risoe (Denmark)). Aug 1981. 127p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82903435.

Portions of document are illegible.

The reference system is based on 6 500-MW(e) BWRs over a 30-year period, ion exchange resins from the water cleanup systems, solidification in cement and bitumen, packaging in drums and concrete molds, temporary storage, transport, and disposal in shallow trench, concrete bunkers, or rock cavern. The safety analysis identifies events that could concievably cause radiation exposure, calculates the doses and compares the risks. (DLC)

0550 Regulations

REFER ALSO TO CITATION(S) 56263, 56275, 56276, 56279, 56280, 56292, 56328, 56390, 56757, 57087, 58008

56392 **(AGNS—35900-CONF-171) Coordination and display of nuclear facility technical and management data.** Bambas, K.J.; Barnes, L.D. (Allied-General Nuclear Services, Barnwell, SC (USA)). Jun 1982. Contract AC09-78ET35900. 11p. (CONF-820713—27). NTIS, PC A02/MF A01. Order Number DE82019992.

From Institute of Nuclear Materials meeting; Washington, DC, USA (19 Jul 1982).

Portions of document are illegible.

A computerized communications and coordination center at the Barnwell Nuclear Fuel Plant provides for rapid cross-flow of information between Computerized Production, Safety, Nuclear Materials Control, and Physical Security information systems. Near real-time data are collected from a wide variety of sensors, instruments, and terminal inputs from each of the Plant's computerized systems and is displayed in a single location on color and black-and-white CRT's in easily understandable graphic and text forms. A foundation for the system has been operated for three years and has expanded in capability each year. In current demonstrations all available plant information networks are tied into a communications network that enables the plant management to review data at a single physical location outside the main control room. The current status of development of the system is described.

56393 **(CONF-810738—) Minutes of the fourth SALE program participants meeting.** (Department of Energy, Argonne, IL (USA). New Brunswick Lab.). Oct 1981. 358p. NTIS, PC A16/MF A01. Order Number DE82017189.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

Portions of document are illegible.

This report is a documentation of the presentations made to the Fourth Safeguards Analytical Laboratory Evaluation (S.A.L.E.) Program Participants Meeting at Argonne, Illinois, July 8-9, 1981. The meeting was sponsored by the US Department of Energy and was coordinated by the S.A.L.E. Program of the New Brunswick Laboratory. The objective of the meeting was to provide a forum through which administration of the Program and methods appropriate to the analysis of S.A.L.E. Program samples could be discussed. The Minutes of the Meeting is a collection of presentations by the speakers at the meeting and of the discussions following the presentations. The presentations are included as submitted by the speakers. The discussion sections were transcribed from tape recordings of the meeting and were edited to clarify and emphasize important comments. Seventeen papers have been abstracted and indexed.

56394 (CONF-810738—, pp 38-59) **Explanation of the methods employed in the statistical evaluation of SALE program data.** Bracey, J.T.; Soriano, M. Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The analysis of Safeguards Analytical Laboratory Evaluation (SALE) bimonthly data is described. Statistical procedures are discussed in Section A, followed by the descriptions of tabular and graphic values in Section B. Calculation formulae for the various statistics in the reports are presented in Section C. SALE data reported to New Brunswick Laboratory (NBL) are entered into a computerized system through routine data processing procedures. Bimonthly and annual reports are generated from this data system. In the bimonthly data analysis, data from the six most recent reporting periods of each laboratory-material-analytical method combination are utilized. Analysis results in the bimonthly reports are only presented for those participants who have reported data at least once during the last 12-month period. Reported values are transformed to relative percent difference values calculated by [(reported value - reference value)/reference value] x 100. Analysis of data is performed on these transformed values. Accordingly, the results given in the bimonthly report are (relative) percent differences (% DIFF). Suspect, large variations are verified with individual participants to eliminate errors in the transcription process. Statistical extreme values are not excluded from bimonthly analysis; all data are used.

56395 (CONF-810738—, pp 60-78) **Some features and applications of an empirical approach to the treatment of measurement data (DoD-method).** Beyrich, W.; Golly, W.; Spannagel, G. (Kernforschungszentrum, GmbH, Karlsruhe, Germany). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

An empirical method of data evaluation is described which allows the derivation of meaningful estimates of the variances of data groups even if they comprise extreme values (outliers). It can be applied to problems usually treated by variance analysis and seems to be suitable to investigate and describe the state of the art of the various analytical methods applied in international safeguards. Some examples are given to illustrate this procedure; they are based on data of the SALE program.

56396 (CONF-810738—, pp 79-84) **Reference values and evaluation of the results of intercomparisons.** Aigner, H.; Deron, S.; Kuhn, E. (IAEA, Seibersdorf, Austria). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The need of a reference value for the composition of materials distributed in intercomparisons is generally recognized. A single reference laboratory or a group of reference laboratories may be used to establish this reference value. The respective advantages and limitations of the two approaches are discussed. The reference measurements must be evaluated to provide the confidence limits of the reference value but also an estimate of the possible heterogeneity of the materials and its samples. The results of the intercomparison measurements should themselves be evaluated to test and discuss the significance of the biases of individual and selected groups of laboratories or techniques. The approach taken by the Analytical Quality Control Services of the International Atomic Energy Agency is illustrated by the SR-1 intercomparison on uranium assay in UO_2 powder.

56397 (CONF-810738—, pp 95-121) **Nuclear material safeguards surveillance and accountancy by isotope correlation techniques.** Persiani, P.J.; Goleb, J.A. Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

This paper presents the initial phase of the US study program and involves the computation of isotopic correlations for the LMFBR fuel cycle. The LWR fuel cycle phase of the study is currently in progress. The selection of the more safeguards effective functionals will depend not only on the level of reliability of isotope correlation technique (ICT) for verification, but also on the capability and difficulty of developing measurement methods. Performance characteristics of existing and proposed isotopic measurement techniques cover the general areas including assay and isotopic wet chemistry and NDA: (1) simultaneous multicomponent analysis techniques, (2) mass spectrometry, (3) x-ray fluorescence or densitometry with high flux monochromatic x-ray sources and high dispersion spectrometers, (4) passive and active neutron interrogation, (5) high level gamma-ray spectroscopy, (6) coulometry, and (7) potentiometry. The measurement capabilities and inherent limitations of these systems are to be evaluated in terms of total systems, operational mode, sample preparation requirements and consequent effect on dissolver solution representation, accuracy and precision estimates (if available), development status of the technique, and development requirements. The isotopic correlation technique shows considerable promise for use in verifying the initial isotopic composition and burnup of discharged assemblies based on the measured ratios of several key isotopes, obtained probably at the dissolver stage in reprocessing. This technique should, for example, easily be capable of indicating the exchange of a blanket assembly for a fuel assembly.

56398 (CONF-810738—, pp 122-130) **Direct method for the fluorometric determination of nanogram quantities of uranium in solution.** Zook, A.C. (New Brunswick Lab., Argonne, IL). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

Pulsed laser ultraviolet light as the excitation source is used in the determination of uranium by fluorometry. To enhance the fluorescent properties of uranium, sodium pyrophosphate and sodium dihydrogen phosphate adjusted to a pH of 7.0 are added to form a uranyl phosphate complex. A major feature of this method is the use of the classic-standard addition technique to eliminate or minimize the effect of interferences. This in effect cancels out matrix effects of the sample fluorescence. Problems encountered and results of this method are discussed. The method is precise and accurate to 2 to 3%, measuring solutions of 0.01 to 4 μg U/g, and capable of measuring much lower concentrations. Time required per measurement is only about 6 minutes, and no preliminary purifications are required.

56399 (CONF-810738—, pp 163-169) **NBL-Davies-Gray weight titration method.** Hassell, C. (New Brunswick Lab., Argonne, IL). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The titration method for uranium consists of the following basic steps: reduction of U^{+6} to U^{+4} by Fe^{+2}; selective oxidation of excess Fe^{+2} by HNO_3 with Mo^{+6} catalyst, all in strong phosphoric acid solution; and titration of the U^{+4} with standard dichromate after dilution. In this paper, detailed procedure of the NBL method, its modification to a gravimetric system or weight titration technique, and miniaturization of the NBL titrimetric method are discussed. Improved precisions and accuracy (2 to 3 times), of the gravimetric titrant delivery has made it possible to reduce the amount of uranium taken for each analysis. At present, using gravimetric delivery, most samples are titrated in the 30 to 50 mg range. Improved precision has led to investigating the possibility of a scaled-down version of the basic method so as to reduce the volume of phosphoric acid waste generated. Because all reactions are carried out in the same vessel, this method can be automated. Analysts at NBL have been able to restrict error to 0.05% or better in the 30 to 100 mg range using the basic procedure.

56400 (CONF-810738—, pp 173-187) **Gravimetric determination of uranium in SALE samples.** Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

As a participant in the Safeguards Analytical Laboratory Evaluation (SALE) program, the Analytical Chemistry Laboratory at General Atomic routinely assays uranium dioxide and uranyl nitrate SALE samples for uranium content. Gravimetric methods are relatively easy and inexpensive to apply when the samples for uranium content. Gravimetric methods are relatively easy and inexpensive to apply when the samples are free from substantial amounts of metallic impurities. Clearly the gravimetric procedure alone is not specific for uranium and must be enhanced by the use of impurity corrections. Emission spectrography is used routinely as the technique of choice for making such corrections. In cases where it is essential to assay specifically for uranium, the modified Davies-Gray titration using a weighed titrant method is applied. In this paper some essential features of these gravimetric and titrimetric procedures are discussed.

56401 (CONF-810738—, pp 188-207) **Isotope dilution mass spectrometry: some present limitations and possibilities to overcome these.** De Bievre, P. (CBNM, Geel, Belgium). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

Thermionic mass spectrometry still has great potential for more precise and accurate measurements but it is going to place tremendous requirements on (1) the chemical purity of the samples we measure, (2) the temperature of both ionization and the filaments and (3) the number of molecular species being handled in ion sources which could increase to several dozen for one type of isotopic analysis. The lack of control by mass spectrometrists over the chemical preparation of the samples for isotopic analysis is an inherent limitation to further improvement of isotope dilution mass spectrometry. A limiting factor in isotope dilution is the ability to measure the ratio. At present, uranium isotopic reference materials are 0.1% and recently one was prepared at 0.05%. As these serve to calibrate isotope ratio measurements one cannot do better than these valves. There is no way in which isotope dilution can be improved until these reference values improve. For plutonium there are not even absolute isotope ratio standards. An agreement has been established between CBNM, Geel and the National Bureau of Standards, Washington, to prepare isotope ratio reference materials jointly so that they will be common to both communities. It is recommended that common batches of reference be established and stored at several places to guarantee accessibility at all times.

56402 (CONF-810738—, pp 218-238) **Evaluation of treatments to attain isotopic equilibration of plutonium preceding the resin bead technique for mass spectrometric assay analysis of spent reactor fuel.** Marsh, S.F.; Abernathey, R.M.; Rein, J.E. (Los Alamos Scientific Lab., NM). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

Ten chemical treatments are evaluated for the attainment of isotopic equilibration of plutonium prior to its sorption on resin beads for assay of dissolved reactor fuel by isotope-dilution mass spectrometry. The one consistently reliable treatment is reduction to Pu(III) with heated ferrous sulfamate followed by oxidation to Pu(IV) with heated sodium nitrite.

56403 (CONF-810738—, pp 239-270) **Evaluation of errors for mass-spectrometric analysis with surface-ionization type mass-spectrometer (statistical evaluation of mass-discrimination effect).** Wada, Y. (Tokai Works, Japan). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The surface-ionization type mass-spectrometer is widely used as an apparatus for quality assurance, accountability and safeguarding of nuclear materials, and for this analysis it has become an important factor to statistically evaluate an analytical error which consists of a random error and a systematic error. The major factor of this systematic error was the mass-discrimination effect. In this paper, various assays for evaluating the factor of variation on the mass-discrimination effect were studied and the data obtained were statistically evaluated. As a result of these analyses, it was proved that the factor of variation on the mass-discrimination effect was not attributed to the acid concentration of sample, sample size on the filament and supplied voltage for a multiplier, but mainly to the filament temperature during the mass-spectrometric analysis. The mass-discrimination effect values β which were usually calculated from the measured data of uranium, plutonium or boron isotopic standard sample were not so significant dependently of the difference of U-235, Pu-239 or B-10 isotopic abundance. Furthermore, in the case of U and Pu, measurement conditions and the mass range of these isotopes were almost similar, and these values β were not statistically significant between U and Pu. On the other hand, the value β for boron was about a third of the value β for U or Pu, but compared with the coefficient of the correction on the mass-discrimination effect for the difference of mass-number, ΔM, these coefficient values were almost the same among U, Pu, and B.As for the isotopic analysis error of U, Pu, Nd and B, it was proved that the isotopic abundance of these elements and the isotopic analysis error were in a relationship of quadratic curves on a logarithmic-logarithmic scale.

56404 (CONF-810738—, pp 271-299) **Controlled-potential coulometric determination of plutonium with a hydrochloric acid-sulfamic acid electrolyte and phosphate complexing.** Jackson, D.D.; Hollen, R.M.; Roensch, F.R.; Rein, J.E. (Los Alamos Scientific Lab., NM). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

Total plutonium is selectively determined by a controlled-potential coulometric method in which plutonium is reduced to Pu(III) at 0.25 V (vs. SCE) in a 5.5 M hydrochloric acid-0.015 M sulfamic acid electrolyte, diverse ions are oxidized at 0.57 V, phosphate is added to reduce the Pu(III)-Pu(IV) potential, and Pu(III) is oxidized to Pu(IV) at 0.68 V. None of more than 50 metal ions present in nuclear fuel-cycle material interferes. Many anions are without effect and most interfering ones are removed by preliminary fuming with perchloric acid. The apparatus described consists mainly of commercial components. The relative standard deviation is $< 0.1\%$ at the 5-mg plutonium level.

56405 (CONF-810738—, pp 300-308) **New Brunswick Laboratory method for the determination of plutonium controlled-potential coulometry.** Holland, M.K.; Weiss, J.R.; Pietri, C.E. (New Brunswick Lab., Argonne, IL). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

Controlled-potential coulometry, as applied at NBL, affords several advantages: (1) the coulometer may be calibrated electrically permitting chemical standards to be used independently to verify method performance and measurement accuracy; (2) plutonium electrolysis proceeds directly to a constant background current approaching zero amperes (1 to 2 μA) which allows the fraction of plutonium electrolyzed to be calculated from the Nernst equation; (3) electrolysis to constant background current in 4 to 6 minutes is readily obtained using the control-potential adjustment technique; and (4) the method is suited to automation.

56406 (CONF-810738—, pp 309-319) **Nondestructive assay of sale materials.** Rodenburg, W.W.; Fleissner, J.G. (Monsanto Research Corp., Miamisburg, OH). Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

This paper covers three primary areas: (1) reasons for performing nondestructive assay on SALE materials; (2) techniques used; and (3) discussion of investigators' revised results. The study shows that nondestructive calorimetric assay of plutonium offers a viable alternative to traditional wet chemical techniques. For these samples, the precision ranged from 0.4 to 0.6% with biases less than 0.2%. Thus, for those materials where sampling errors are the predominant source of uncertainty, this technique can provide improved accuracy and precision while saving time and money as well as reducing the amount of liquid wastes to be handled. In addition, high resolution gamma-ray spectroscopy measurements of solids can provide isotopic analysis data in a cost effective and timely manner. The timeliness of the method can be especially useful to the plant operator for production control and quality control measurements.

56407 (CONF-810738—, pp 321-350) **Problems and progress in the preparation of sources for the alpha spectrometry of plutonium.** Miguel, M. (IAEA, Vienna, Austria); Deron, S.; Swietly, H.; Heinonen, O.J. Oct 1981. NTIS, PC A16/MF A01.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The interpretation of non-destructive measurements of plutonium materials require more accurate determinations of the isotopic abundance of Pu-238 than conventional chemical assays. The requirements of calorimetry, passive neutron and conventional chemical assays are presented and compared. When Pu-238 is measured by alpha spectrometry, these requirements define how well the plutonium must be separated from americium, and what should be the accuracy of the spectrometry. The latter can strongly depend upon the resolution of the alpha spectrum. The authors describe a procedure to produce sources by drop deposition which ensure a resolution of 17 keV with commercial instrumentation.

56408 **(INIS-mf—7105) Atomic energy: exchange of letters between Canada and the European Atomic Energy Community (EURATOM).** 16 Jan 1978. 45p. (In English and French). NTIS (US Sales Only), PC A03/MF A01.

Letters exchanged between the Charge d'affaires, mission of Canada to the European Communites and the Commissioner of the European Communities, concerning safeguards, levels of physical protection, and further intra-Community trade of nuclear materials exported from Canada to the European Community.

56409 **(INIS-mf—7106) Atomic energy: agreement between Canada and Sweden.** 17 Nov 1978. 36p. (In English and French). B. Order Number DE82780643.

An agreement between Canada and Sweden concerning the transfer of nuclear material, facilities and information.

56410 **(NUREG—0430-V1-N7) Licensed fuel facility status report. Semi-annual report 1 Jul 80-31 Dec 80.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jan 1982. 63p. NTIS, PC A04/MF A01.

The Licensed Fuel Facility Status Report (NUREG-0430) is a periodic report that routinely provides information on licensed fuel facilities. The information included in NUREG-0430 consists of facility data, NRC inspection results, licensee event reports, radioactive effluent data, and inventory difference data. This report identifies the licensee and the plant status, as well as NRC inspection results and summaries through December 1980. The report includes licensee performance data as identified below: (1) Licensee event reports as required by 10 CFR Parts 20, 40, 50, 70, 71, and 73 and by license conditions; (2) The quantities of radioactive materials released to the environment via gaseous or liquid effluent as required to be reported by 10 CFR 40.65; and (3) Inventory difference data, also referred to as 'MUF' (Material Unaccounted For), for those fuel cycle facilities which possess significant quantities of strategic special nuclear material or low enriched uranium. The time period covered by this report is July 1, 1980 to December 31, 1980.

56411 **(NUREG/BR—0025-82/01) Information report on state legislation: Volume 8, Number 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). Jan 1982. 27p. NTIS, PC A03/MF A01.

This edition is a complete summary of all State laws involving nuclear issues which were enacted in 1981. The summaries are listed alphabetically by State and include the date each was enacted. There are now 22 categories into which the laws are indexed. A definition of all the new categories and the issues they encompass is included. This list will be used throughout the year to categorize the bills, resolutions and initiatives.

56412 **(NUREG/BR—0025-82/02) Information report on state legislation: Volume 8, Number 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). Feb 1982. 11p. NTIS, PC A02/MF A01.

States are becoming increasingly aware of the importance and cost benefits of exploring various types of renewable energy resources and conservation techniques. In response to this need, many States have formed energy offices and commissions to perform studies on these issues or develop and promote energy resources and report their findings to the legislature (see Colorado S-16, Indiana H-1408, Massachusetts S-195, for example). In the low-level waste area, the NRC's Office of State Programs commented on the draft form of both the Rocky Mountain States Low-Level Waste Compact and the Central States Low-Level Waste Compact in January, and those States hope to introduce compact legislation soon.

56413 **(NUREG/BR—0025-82/03) Information report on state legislation: Volume 8, Number 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of International and State Programs). Mar 1982. 11p. NTIS, PC A02/MF A01.

All eligible States (except North Carolina) have introduced legislation adopting the Southeast Low-Level Waste Compact. The States which have introduced Compact Legislation reported in this issue are Alabama, Florida, Georgia and Virginia. A number of State and local governments have enacted bans on transportation of radioactive material through their jurisdiction.

56414 **(PNL—3852) A method for determining allowable residual contamination levels of radionuclide mixtures in soil.** Napier, B.A. (Pacific Northwest Lab., Richland, WA (USA)). May 1982. Contract AC06-76RL01830. 68p. NTIS, PC A04/MF A01. Order Number DE82015838.

An important consideration in the disposal of radioactive wastes, and consequently in the preparation of plans for remedial actions at contaminated sites, is the amount of radioactive contamination that may be allowed to remain at any particular waste site. The allowable residual contamination level (ARCL) is dependent on the radiation dose limit imposed, the physical and environmental characteristics of the waste site, and the time at which exposure to the wastes is assumed to occur. The steps in generating an ARCL are generally as follows: (1) develop plausible, credible site-specific exposure scenario; (2) calculate maximum annual radiation doses to an individual for each radionuclide based on the existing physical characteristics of the waste site and the site-specific exposure scenario; (3) calculate the ARCL for the dose limit desired, including all radionuclides present, uncorrected for site cleanup or barrier considerations; and (4) apply any corrections for proposed cleanup activity or addition of barriers to waste migration or uptake to obtain the ARCL applicable to the proposed action. Use of this method allows appropriate application of resources to achieve uniform compliance with a single regulatory standard, i.e., a radiation dose rate limit. Application and modification of the ARCL method requires appropriate models of the environmental transport and fate of radionuclides. Example calculations are given for several specific waste forms and waste site types in order to demonstrate the technique and generate comparisons with other approaches.

56415 **Dye filled security seal.** Wilson, D.C. (to Department Of Energy). US Patent 4,326,741. 27 Apr 1982. Filed date 18 Jul 1980. vp. PAT-APPL-170253.

A security seal for providing an indication of unauthorized access to a sealed object includes an elongate member to be entwined in the object such that access is denied unless the member is removed. The elongate member has a hollow, pressurizable chamber extending throughout its length that is filled with a permanent dye under greater than atmospheric pressure. Attempts to cut the member and weld it together are revealed when dye flows through a rupture in the chamber wall and stains the outside surface of the member.

56416 **Calculation of neutron die-away times in a large-vehicle portal monitor.** Lillie, R.A.; Santoro, R.T.; Alsmiller, R.G. Jr. (Oak Ridge Natl Lab, Tenn, USA). *Nuclear Technology;* **52**: No. 2, 313-318(Feb 1981).

In this paper, Monte Carlo methods are employed to investigate the adequacy of using neutron die-away time measurements to detect the movement of various amounts of shielding materials through a large tunnel detection system. Neutron die-away times are calculated and compared for an empty tunnel and for a tunnel containing a tractor trailer with five different local configurations. 5 refs.

56417 **Nuclear fuel service centers.** Zwickler, S.A. (Burns and Roe Ind Serv Corp, Paramus, NJ). *Alternative Energy Sources;* **6**: 2357-2374(1981). (CONF-791204—).

From 2. Miami international conference on alternative energy sources; Miami Beach, FL, USA (10 Dec 1979).

The commercial nuclear power industry principally uses low enriched uranium (LEU) fuels in Light Water Reactors (LWR). However, the worldwide reserves of uranium are limited and, although the actual quantity remains to be established, it is generally agreed that these resources, which provide the only naturally occurring fissile isotope U-235, will be exhausted in the foreseeable future. This paper discusses International Fuel Service Centers (IFSC), in which the sensitive fuel cycle facilities are grouped into a common, heavily safeguarded site. The study described was initiated as part of the Non-Proliferation Alternative Systems Assessment Program (NASAP).

56418 **Hardware options for SNM vault inventory systems.** Arlowe, H.D.; Miyoshi, D.S. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **39**: 220-221(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56419 **IAEA safeguards: experience to date - an overview.** Keppin, G.R. (LANL, Los Alamos, NM). *Transactions of the American Nuclear Society;* **39**: 306-307(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56420 **Impact of IAEA safeguards on DOE safeguards activities.** Hammond, G.A.; McDowell, S.C.T. (DOE, Washington, DC 20545). *Transactions of the American Nuclear Society;* **39**: 313-314(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56421 **The effect of IAEA safeguards on systems design.** Shipley, J.P. (LANL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **39**: 316-317(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56422 **Practical standards for passive gamma-ray assay.** Parker, J.L. (LANL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **39**: 319-320(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

56423 **Nuclear material safeguards surveillance and accountancy by isotope correlation techniques.** Goleb, J.A.; Kroc, T.K.; Persiani, P.K. (DOE, Washington, DC 20545). *Transactions of the American Nuclear Society;* **39**: 322-323(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

06 FUSION FUELS

0602 Processing

56424 **(CEA-CONF—6075) Target fabrication using laser and spark erosion machining.** Clement, X.; Coudeville, A.; Eyharts, P.; Perrine , J.P.; Rouillard, R. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Nov 1981. 14p. (CONF-811113—52). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702260.

From American Vacuum Society national symposium; Anaheim, CA, USA (3 Nov 1981).

Lasers and E.D.M. (electrical discharge machining) are both extremely useful tools for machining the small targets needed in inertial confinement studies. Lasers are currently used in a wide range of target problems and it appears that E.D.M. has a still wider range of applications for plane and spherical targets. The problems of material deformation and tool breaking are practically eliminated as the electrode and the machined part are not in mechanical contact. In comparison with laser micromachining E.D.M. offers: larger versatility with the possibility of new developments and applications; higher production speed for thin conducting materials; lower initial and operating costs; the processes are well controlled, reproducible and can be easily automated; the operation is safe without the dangers associted with lasers.

56425 **Flash x radiography of laser-accelerated targets.** Whitlock, R.R.; Obenschain, S.P.; Grun, J. (U. S. Naval Research Laboratory, Washington, D. C. 20375). *Applied Physics Letters;* **41**: No. 5, 429-431(1 Sep 1982).

Flash x radiography of ablatively accelerated planar foils has provided quantitative measurements and qualitative observations regarding several parameters of critical interest to direct illumination laser fusion. A 1.05-μ, 3.3-ns driver beam was focused onto carbon foils in a large (0.7—1-mm diameter) spot to reduce edge effects. From images produced by a backlighting x-ray flash, we have measured overall coupling efficiency, smoothing of laser nonuniformities, target velocity, and ablation pressure. The high velocity targets maintain a localized, high density ($>3\%$ of solid). In contrast to other workers' recent measurement of pressure from x-ray imaging, our x-radiographic results, including pressure, are in general agreement with earlier NRL studies. Our results have also provided further insights into double foil interactions and planar target preheat measurements.

56426 **Process for manufacture of inertial confinement fusion targets and resulting product.** Masnari, N.A.; Rensel, W.B.; Robinson, M.G.; Solomon, D.E.; Wise, K.D.; Wuttke, G.H. (to Department Of Energy). US Patent 4,323,420. 6 Apr 1982. Filed date 17 Jul 1978. vp.

PAT-APPL-925437.

An icf target comprising a spherical pellet of fusion fuel surrounded by a concentric shell; and a process for manufacturing the same which includes the steps of forming hemispheric shells of a silicon or other substrate material, adhering the shell segments to each other with a fuel pellet contained concentrically therein, then separating the individual targets from the parent substrate. Formation of hemispheric cavities by deposition or coating of a mold substrate is also described. Coatings or membranes may also be applied to the interior of the hemispheric segments prior to joining.

0603 By-products

56427 **Thermo-chemical production of hydrogen using a two temperature-zone blanket.** Galloway, T.R.; Ribe, F.L.; Rowe, D.S.; Woodruff, G.L. (LLNL, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **39**: 266-268(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 57579, 57580, 57581, 57583, 57584, 57585, 57586, 57587, 57588

0702 Radiation Sources

REFER ALSO TO CITATION(S) 57915

56428 **(AD-A—111352/1) Techniques suitable for a portable wear metal analyzer. Final report Oct 80-Apr 81.** Niu, W.H.; Andersen, E.B.; Fergusson, G.J. (Perkin-Elmer Corp., Pomona, CA (USA). Aerospace Div.). Sep 1981. 89p. NTIS, PC A05/MF A01.

A literature study for the techniques suitable for a portable wear metal analyzer has been conducted. The intent was to locate a technique which could lead to the development of a deployable field instrument to analyze metals in used aircraft engine oil for preventive maintenance purposes. Ten techniques, including six optical spectroscopic methods, two x-ray techniques, radioactive tagging, and colorimetry, were evaluated. Emphasis was placed on the fundamental limitations of each technique for this particular application. As a result, three optical techniques looked promising and their practicality was further investigated. The final assessment of these three techniques was based on the feasibility of making the instrument portable, low cost, able to analyze elements of interest, particle size independent, and with moderate power consumption. The three techniques, in order of suitability are: furnace atomic absorption spectroscopy, rotating disc electrode atomic emission spectroscopy, and DC plasma atomic emission spectroscopy.

56429 **(ZFI-Mitt—39) Proceedings of the KDT meeting on isotopes for rationalization in industry.** (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1981. 155p. (In German). (CONF-8006240—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82780716.

From KDT meeting on isotopes for rationalization in industry; Leipzig, German Democratic Republic (4 Jun 1980).

Selected papers are indexed separately.

0703 Isotopic Power Supplies

56430 **(DPSPU—81-30-18) Welding iridium heat-source capsules for space missions.** Kanne, W.R. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Mar 1982. Contract AC09-76SR00001. 20p. (CONF-820449—2). NTIS, PC A02/MF A01. Order Number DE82020098.

From 63. annual meeting of the American Welding Society; Kansas City, MO, USA (26 Apr 1982).

A remote computer-controlled welding station was developed to encapsulate radioactive PuO_2 in iridium. Weld quench cracking caused an interruption in production of capsules for upcoming space missions. Hot crack sensitivity of the DOP-26 iridium alloy was associated with low melting constituents in the grain boundaries. The extent of cracking was reduced but could not be eliminated by changes to the welding operation. An ultrasonic test was developed to detect underbead cracks exceeding a threshold size. Production was continued using the ultrasonic test to reject capsules with detectable cracks.

56431 **(LA—9371-PR) Flight-systems safety program. Progress report, January 1982.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). May 1982. Contract W-7405-ENG-36. 14p. NTIS, PC A02/MF A01. Order Number DE82016137.

This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Coordination and Special Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed here are ongoing. Results and conclusions described may change as the work continues. Published reference of the results cited in this report should not be made without the explicit permission of the person in charge of the work.

56432 **(LA—9403-PR) Flight-systems safety program. Progress report, February 1982.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 18p. NTIS, PC A02/MF A01. Order Number DE82016372.

This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Coordination and Special Projects of the US Department of Energy by los Alamos National Laboratory. Most of the studies discussed here are ongoing. Results and conclusions described may change as the work continues. Published reference of the results cited in this report should not be made without the explicit permission of the person in charge of the work.

56433 **(LA—9476-PR) Flight-Systems Safety Program, April 1982. Progress report.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1982. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01. Order Number DE82021833.

This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Coordination and Special Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed here are ongoing. Results and conclusions described may change as the work continues. Published reference of the results cited in this report should not be made without the explicit permission of the person in charge of the work.

08 HYDROGEN

56434 **Hydrogen energy system. Proceedings of the second world hydrogen energy conference. Volumes 1-5.** Veziroglu, T.N.; Seifritz, W. Oxford, England; Pergamon Press (1979). vp. (CONF-780807—).

From 2. world hydrogen energy conference; Zurich, Switzerland (21 Aug 1978).

Papers are presented on recent developments in hydrogen energy systems, including primary energy sources electrolytic, thermochemical, and hybrid hydrogen production hydrogen production from fossil fuels transmission and distribution, and storage. Other topics include nuclear energy as a primary energy source for hydrogen production, the conversion of solar energy into hydrogen, improvements in alkaline electrolysis technology, the development of solid polymer electrolyte electrolysis systems, the atomic sulfur-iodine water splitting cycle, the electrolysis of hydrobromic acid, the ZnSe thermochemical hydrogen production cycle, and the industrial-scale production of hydrogen from natural gas, naphtha, and coal. Attention is also given to solar-thermochemical hydrogen production from water, plasma-chemical hydrogen production, photoelectrochemical hydrogen production, gas distribution equipment for hydrogen, cryogenic hydrogen storage, and the development of low-cost nickel-rare earth hydrides for hydrogen storage.

0801 Production

REFER ALSO TO CITATION(S) 56508, 56509, 57158, 57298

56435 **(BNL—51573) Advanced alkaline electrolysis-cell development, Contract summary report. Development of electrolysis operation cell separator for 125°C.** Murray, J.N. (Brookhaven National Lab., Upton, NY (USA); Teledyne Energy Systems, Timonium, MD (USA)). Apr 1982. Contract AC02-76CH00016. 126p. NTIS, PC A07/MF A01. Order Number DE82020697.

During previous studies a significantly higher efficiency hydrogen evolution electrode was identified and shown to have reasonable electrode stability when utilized in applied research sized, alkaline electrolyte water electrolysis equipment operated at 100°C. The six-month effort described in this report identifies the development of a new electrode separator that will allow continuous water electrolysis at 125°C. The new separator has nearly identical mechanical characteristics relative to the existing commercial asbestos separator which appears to be limited chemically to operation below 90°C. In addition, new insight into the requirements for an improved anode structure was found and the progress in anode improvements is also discussed. The reporting requirements for participation as part of the International Energy Agency hydrogen production research and development program are included as an appendix to the report.

56436 **(PB—82-157801) Comparison of metals as catalysts for the photolysis of water. Completion report, 1 October 1980-30 September 1981.** Webb, T.R. (Auburn Univ., AL (USA). Dept. of Chemistry). 30 Nov 1980. 13p. NTIS, PC A02/MF A01.

A study of the platinum-catalyzed photolysis of water to produce hydrogen is described. Experiments indicated that rhodium could be substituted for platinum as catalyst, that palladium was feebly effective, and that ruthenium, gold, iridium, and silver were not effective. Studies of related ruthenium and iron complexes showed that ruthenium-phenanthroline and iron-phenanthroline complexes could work as light-absorbing species in place of a more studied ruthenium-bipyridine complex; europium ion showed some promise as an electron-transfer reagent. Preliminary experiments suggest that hydrogenation of double bonds occurs in the system.

56437 **Catalytic cartridge SO3 decomposer.** Galloway, T.R. (to Department Of Energy). US Patent 4,331,632. 25 May 1982. Filed date 18 Nov 1980. vp.

PAT-APPL-208218.

A catalytic cartridge surrounding a heat pipe driven by a heat source is utilized as a SO3 decomposer for thermochemical hydrogen production. The cartridge has two embodiments, a cross-flow cartridge and an axial flow cartridge. In the cross-flow cartridge, SO3 gas is flowed through a chamber and incident normally to a catalyst coated tube extending through the chamber, the catalyst coated tube surrounding the heat pipe. In the axialflow cartridge, so3 gas is flowed through the annular space between concentric inner and outer cylindrical walls, the inner cylindrical wall being coated by a catalyst and surrounding the heat pipe. The modular cartridge decomposer provides high thermal efficiency, high conversion efficiency, and increased safety.

56438 **Preliminary results from bench-scale testing of a sulfur-iodine thermochemical water-splitting cycle.** O'Keefe, D. (General Atomic Co., San Diego, CA); Allen, C.; Besenbruch, G.; Brown, L.; Norman, J.; Sharp, R.; McCorkle, K. *International Journal of Hydrogen Energy;* 7: No. 5, 381-392(1982). Contract AC02-80ET26225.

From 20. national convention, joint meeting AIChE-IMIQ; Acapulco, Mexico (15 Oct 1980).

Portions of a bench-scale model of a sulfur-iodine thermochemical water-splitting cycle have been operated at General Atomic Company as part of a comprehensive program to demonstrate the technology for hydrogen production from non-fossil sources. The bench-scale model consists of three subunits which can be operated separately or together and is capable of producing as much as $41/min^{-1}$ ($6.7 \times 10^{-5} m^3 s^{-1}$) at standard conditions of gaseous hydrogen. One subunit (main solution reaction) reacts liquid water, liquid iodine (I_2) and gaseous sulfur dioxide (SO_2) to form two separable liquid phases: 50 wt % sulfuric acid (H_2SO_4) and a solution of iodine in hydroiodic acid (HI/sub x/). Another subunit (H_2SO_4 concentration and decomposition) concentrates the H_2SO_4 phase to the azeotropic composition, then decomposes it at high temperature over a catalyst to form gaseous SO_2 and oxygen. The third subunit (HI separation and decomposition) separates the HI from water and I_2 by extractive distillation with phosphoric acid (H_3PO_4) and decomposes the HI in the vapor phase over a catalyst to form I_2 and product hydrogen. This paper presents the results of ongoing parametric studies to determine the operating characteristics, performance, and capacity limitations of major components.

56439 Utilization of $ZnSO_4$ decomposition in thermochemical hydrogen cycles. Krikorian, O.H.; Shell, P.K. (Lawrence Livermore National Lab., CA). *International Journal of Hydrogen Energy;* 7: No. 6, 463-469(1982). Contract W-7405-ENG-48.

It was found that the $ZnSO_4$ decomposition reaction can be used as the high temperature step in a number of thermochemical cycles. It is especially applicable as a substitute for the H_2SO_4 decomposition step in H_2SO_4-based cycles, and significantly improves the efficiency of such cycles. In this study, an initial look was taken at the effects of heat-up rate on the decomposition of $ZnSO_4$ as it is heated through an α-β transition at 1015K. It was found that a rapid heat-up of fine $ZnSO_4$ particulates through this transition leads to fracturing of the $ZnSO_4$ crystallites and significantly enhances its subsequent decomposition rate at $\sim$ 1043K. Evidence was also found for an autocatalytic decomposition process in fine $ZnSO_4$ particulates with either rapid or slow heat-up rates. It is believed that a combination of (1) fracturing of the crystallites and (2) surface catalysis by ZnO to equilibrate the $SO_3/SO_2/O_2$ gaseous products contributes to the observed autocatalytic behavior.

0802 Storage

REFER ALSO TO CITATION(S) 57025

56440 Quenching of dilute Mg-H alloys. Schober, T.; Chason, M.K. (Argonne Natl Lab, Ill, USA). *Scripta Metallurgica;* **15**: No. 7, 791-794(Jul 1981).

The work is concerned with the nature of the quench product(s) when dilute samples are quenched from temperatures not far below T/sub m/ to room temperature. At -130/degree/C only MgH/sub 2/ particles were formed. Observation of hydrides at room temperature caused their immediate destruction and the appearance of H/sub 2/ gas bubbles. Further heating led to formation of a cavity. 20 refs.

0804 Marketing And Economics

REFER ALSO TO CITATION(S) 57298

56441 (PB—82-157611) Importance of hydrogen in future energy demand and supply. Final report. Eickhoff, H.G.; Martinsen, D.; Patzak, R.; Voss, A. (Commission of the European Communities, Luxembourg). [nd]. 292p. (EUR—6962-DE). NTIS PC E11/MF E11.

The potential of hydrogen as a source of energy for the Federal Republic of Germany is considered in relation to present and future energy requirements by the industrial, transport and domestic sectors. The energy supply from fossil fuels - solid, liquid, and gaseous, indigenous and imported - from nuclear power stations and from natural regenerative sources is reviewed. The various processes for the production of hydrogen are described; safety aspects are mentioned. Its industrial use as a raw material including its use in the conversion of coal to liquid fuels is described. Attention is drawn to storage and transportation problems in comparison with those of natural gas and substitute natural gas. Cost/effectiveness aspects play a prominent part throughout the report.

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 56709

0808 Properties

56442 (AD-A—108843/4) Weak and strong ignition. II. Sensitivity of the hydrogen-oxygen system. Memorandum report. Oran, E.S.; Boris, J.P. (Naval Research Lab., Washington, DC (USA)). 7 Dec 1981. 39p. (NRL-MR—4671). NTIS, PC A03/MF A01.

This paper identifies the physical and chemical mechanisms which cause certain mixtures of hydrogen, oxygen and argon to be very sensitive to sound wave or entropy (temperature) perturbations. Detailed simulations of the effects of sound waves in typical mixtures are used to show explicity the effects of such fluctuations on the chemical induction time. A quantity delta TAU max, is defined which represents the maximum variation produced in the chemical induction time of a system given the amplitude and frequency of a perturbation. It is observed that these perturbations may cause ignition to occur unevenly in such mixtures and this leads to ignition which appears spotty. Using detailed numerical simulations and a generalized induction parameter model derived from it, delta TAU max is evaluated and a criterion is developed for spotty and smooth ignition behind reflected shock waves. These effects are related to weak and strong ignition observed in shock tube experiments.

56443 (FOA-C—20408-D1) Influence of stone walls on the explosion propagation of an air hydrogen mixture in an enclosed space. Almstroem, H.; Berglund, S. (Research Inst. of National Defence, Stockholm (Sweden)). May 1981. 82p. (SWEDISH). NTIS, PC A05/MF A01.

The cushioning effect of rocks on detonations in a closed environment was investigated. In the test the pressure time elapse in six spots on a vertically oriented shock pipe 240 cm ion, 25 cm diameter were measured. Tests were conducted using five different types of stone filling. In most of the experiments, an air hydrogen mixture was used. One stone filling was tested with varying air hydrogen concentrations. The capability of the stone filling to transmit impulses to the wall of the pipe were evaluated in an experiment. The total impulses transmitted to the bottom area of a small pipe (70 cm in length) was measured.

56444 (NASA-CR—168914) Supersonic burning in separated flow regions. final report. Zumwalt, G.W. (Wichita State Univ., KS (USA)). Apr 1982. 53p. NTIS, PC A04/MF A01.

The trough vortex phenomena is used for combustion of hydrogen in a supersonic air stream. This was done in small sizes suitable for igniters in supersonic combustion ramjets so long as the boundary layer displacement thickness is less than 25% of the trough step height. A simple electric spark, properly positioned, ignites the hydrogen in the trough corner. The resulting flame is self sustaining and reignitable. Hydrogen can be injected at the base wall or immediately upstream of the trough. The hydrogen is introduced at low velocity to permit it to be drawn into the corner vortex system and thus experience a long residence time in the combustion region. The igniters can be placed on a skewed back step for angles at least up to 30 deg. without affecting the igniter performance significantly. Certain metals (platinum, copper) act catalytically to improve ignition.

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 57110

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 56000, 56040, 56046, 56101, 56457, 56510, 57837, 57838, 57839

56445 (AD-A—110380/3) **Syntheses of synthetic hydrocarbons via alpha olefins. Final report Jul 80-Jun 81.** Cupples, B.L.; Kresge, A.N.; Onopchenko, A.; Pellegrini, J.P. Jr. (Gulf Research and Development Co., Pittsburgh, PA (USA)). Oct 1981. 56p. NTIS, PC A04/MF A01.

This work involved (1) review of literature data, (2) acquisition of experimental data, and (3) development of a correlation diagram for relating the structure of paraffinic hydrocarbons with physical properties such as viscosity, pour point, and thermal stability. Further work involved (4) evaluation of several catalysts, (5) comparison of high and low conversion runs in the BF3-catalyzed oligomerization of 1-decene, and (6) screening synthetic procedures for preparing tetrasubstituted methanes having three equal groups and a methyl group.

56446 (DOE/PC/40283—T1) **Fundamental and semi-global kinetic mechanisms of hydrocarbon combustion. Annual report, 1 July 1981-30 June 1982.** Brezinsky, K.; Dryer, F.L. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). 30 Jul 1982. Contract FG22-81PC40283. 103p. NTIS, PC A06/MF A01. Order Number DE82018225.

Portions of document are illegible.

This document details technical progress made on this effort over the first twelve months of the program and compares this progress with the original program requirements and work plan. Because the program is part of the Syn-Fuel Utilization effort which is projected to be zero-budgeted for Fiscal 1983, it is anticipated that there may not be further funds beyond those currently obligated for the period July 1, 1981-January 31, 1983. Thus a revised work statement and schedule to cover the period July 1, 1982-January 31, 1983 which will produce a reasonable condition at which to end the current program appears as an appendix in this report. Those program elements we will be unable to complete under this program are important to the combustion field in general and syn fuels utilization in particular. We believe it important to continue the work under additional funding, either as a result of a change in the status of the proposed Syn-Fuels Utilization Budget or from another Department of Energy Program. Progress reports cover the following three tasks: chain hydrocarbon oxidation studies; detailed kinetic studies; aromatic oxidation studies.

56447 (DOE/PETC/TR—82/14) **Fischer-Tropsch studies with catalyst-sprayed tube wall reactors.** Zarochak, M.F.; Pennline, H.W.; Schehl, R.R. (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Energy Technology Center). Aug 1982. 96p. NTIS, PC A05/MF A01. Order Number DE82020084.

A summary of Fischer-Tropsch studies in bench-scale tube wall reactors using flame-sprayed catalysts is presented. Preliminary studies were conducted with various flame-sprayed catalysts, after which taconite was chosen as the prime candidate for more extensive evaluation. Results from several life tests with promoted and unpromoted taconite are reported, along with a data base that discusses the effects of various process variables on catalyst activity and product selectivity.

56448 (STUB—4) **Biogas technology in Denmark. Comparison of anaerobic digester designs.** Groen, G. (STUB Samarbejdsgruppen for Teknologisk Udvikling af Biogas, Glostrup (Denmark)). Mar 1981. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82750468.

Portions of document are illegible.

The original project programme, which aimed at an adaption and development of a biogas technology suitable for Danish farm operations has been updated since April 1980 and extended to cover new activities as a trouble-shooting service aimed to assist owners and builders of biogas plants, research into specific technology problems, and hardware development in relation to that. Some of these are: mixing, heat exchanging, gas purification and gas utilization. Based on today's market situation and the present development in energy prices and interest level, the "market price" of a plant has been calculated to approximately 300,000 D.kr. (1981) in total construction costs including installation and connections to the mechanical and electrical services of the farm. The plant will produce approximately 140 m^3 biogas per day (65% methane) from 400 kg V.S. per day (cattle) or 320 kg V.S. per day (swine) and the annual maintenance costs shall be in the area of 5,000 - 10,000 D.kr. The three existing demonstration plants are designed for a semicontinious, mesophilic operation with feeding-in at least each day. The first year operation of the plants has been a period with lots of bothering mechanical problems to be dealt with. Basic tehnical and economical information concerning the plants and the farms form the basis for economical analyses. These are carried out using the recorded production rates and the equivalent prices for energy. Input- and output rates are recorded daily by the owner (manure - gas - electricity - heat).

56449 (STUB—6) **Biogas demonstration plants. Designing, construction and operation of 3 industrial-scale systems.** (STUB Samarbejdsgruppen for Teknologisk Udvikling af Biogas, Glostrup (Denmark)). Nov 1981. 78p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82750469.

Portions of document are illegible.

Experience collected by operating 3 industrial scale demonstration plants prove the parameters like process temperature, batches and durability to be suitable for biogas production of manures. Energy consumption during the process is reasonable, gas yield is high for pig-manure, while cattle manure gives less than expected. Corrosion of reactors can be avoided by installation of plastic tubes cover plates, and details in the manure reactors. Biogas is aggressive and has to be dried and purified. Biogas systems have to be built wholesome, gas production is optimal after 1-1/2 week for cattle manure and 1 to 11/2 month for pig-manure. Second generation biogas system designed now will be 1-step mixing mesophilic, continuous system with volume $100m^3$ corresponding to about 70 cows. It is constructed at State Agrotechnical Experimental Center Bygholm (c/o Horsens) and based on former experience.

56450 **Raman spectra of CO adsorbed on Ni(100).** Bradley, E.B.; Arunkumar, K.A. (Univ. of Kentucky, Lexington). *Spectroscopy Letters;* **15**: No. 2, 113-124(1982). Contract AS05-79ER10447.

Experimental results are discussed for laser Raman spectra of CO adsorbed on Ni(100) at -131°C. Raman shifts are observed at 2050, 2028, 466 and 419 cm^{-1}. Assignments are made for the modes based upon C_2/sub v/ and C_4/sub v/ point groups. The assignments are compared with earlier experimental and theoretical work. 2 figures, 1 table.

56451 **Background-free CARS studies of carbon monoxide in a flame.** Rahn, L.A.; Zych, L.J.; Mattern, P.L. (Sandia Laboratories, Livermore, Calif.). *Optics Communications;* **30**: 249-252(Aug 1979).

Background-free coherent anti-Stokes Raman spectra (CARS) of carbon monoxide have been obtained in a rich methane-air flat flame. Use of this background rejection method, requiring only two laser frequencies, results in an increase in signal-to-noise of over 200 in the /chi(3)/2 spectrum in comparison with normal CARS. In addition, this technique provides a means for determining the symmetry of observed Raman transitions. The principles of background-free CARS are derived, and the capabilities are demonstrated with experimental data.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 56002, 56487, 56488, 56496, 56497, 56498, 56499, 56500, 56501, 56502, 56503, 56504, 56505, 56506, 56512, 56527, 57129

56452 (DOE/RA/50299—1119-Vol.4) **Coal to methanol feasibility study: Beluga methanol project. Volume IV. Environmental. Final report.** (Cook Inlet Region, Inc./Placer Amex, Inc., San Francisco, CA (USA)). Sep 1981. Contract FG01-80RA50299. 472p. NTIS, PC A21/MF A01. Order Number DE82006057.

Portions of document are illegible.

The objectives of the environmental, health, safety and socioeconomic assessment tasks of this feasibilty study were to define the major environmental issues relevant to development of a coal gasification and methanol fuels production facility and related coal mining activities and transportation systems in the west Cook Inlet area, Alaska. To achieve this, extensive review into existing information on the Beluga region of west Cook Inlet was conducted and updated with the findings of current and on-going land resource projects. Specific field activities then were initiated to expand the environmental data base in areas relevant to this project where there was a paucity of information. Based on these findings the project was reviewed in detail to identify significant environmental issues and to outline the state and federal permit requirements to ensure that these elements are an integral component of all subsequent project planning and management decisions. This document includes the results of literature review and substantial contributions from the 1981 field program. The report also incorporates input from various state and federal agencies, from other consultants participating in the feasibility study, and from the staffs of both CIRI and Placer Amex.

56453 (PB—82-145152) Ethanol production in Suffolk County, New York: technical and economic feasibility. Final report. Kalter, R.J.; Boisvert, R.N.; Gabler, E.C.; Walker, L.P.; Pellerin, R.A. (Cornell Univ., Ithaca, NY (USA)). Sep 1981. 197p. NTIS, PC A09/MF A01.

This is the fourth of five region-specific feasibility studies on regional production of ethanol. The results indicate that conventional ethanol production from potatoes and corn, the candidate crops available in Suffolk County, is not strongly attractive for several reasons -- storage problems, seasonality, and high cost. As for corn, which is not grown locally in large quantities, the study shows that transportation costs of corn from other locations would present a disadvantage to a plant of this type based in Suffolk County. Ethanol is an octane booster which can be used as a gasoline extender to produce gasohol.

56454 (PB—82-171489) Enzymatic tranformations of lignin. Annual report 1 July 1980-30 June 1981. Glasser, W.G.; Hall, P.L. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jun 1981. 175p. NTIS, PC A08/MF A01.

Research is summarized on biological approaches to the utilization of lignin degradation to raw material for the manufacture of chemicals and materials. This investigation studied the possible involvement of reduced oxygen species produced by the white-rot fungus, C. versicolor, in the initial breakdown of the lignin macromolecule during its biodegradation. This fungus was shown to be capable of exporting superoxide radical. While the degree to which this organism was responsible for actual lignin degradation is not clear, there were indications that a correlation may exist between the concentration of extracellular superoxide radical in the medium and the extent of lignin degradation. Two different fermentation schemes were compared and several control fermentation experiments were made. Research dealing with improvements in lignin structure analysis, liquefaction of lignin preparations by reaction with propylene oxide, and solidification of liquified kraft lignin by crosslinking with diisocyanate compounds was explored. The use of scanning electron microscopy for revealing interaction between fiber and binder is noted.

56455 (PB—82-178476) United packing: Alcohol feasibility study. Final report. (Brown and Caldwell, Walnut Creek, CA (USA)). Oct 1981. 83p. NTIS, PC A05/MF A01.

The disposal of cull fruit coming from packing sheds is a large but seasonal solid waste management problem in the Central Valley. Present disposal practices include landfilling, land spreading, and use as animal feed. Typically, these methods represent an economic liability to the packers in addition to being a waste of potential resources. Cull fruit contains significant amounts of sugar which can be converted into ethanol using current technology. The ethanol has several uses, one of which is a fuel to provide on-site energy for plant processing needs. This report was intended to evaluate the potential for ethanol production from cull fruit at United Packing's Sanger plant. However, ethanol production is only one part in an overall energy management plan for the plant. Cogeneration and other power production options utilizing ethanol, to provide both total and partial energy independence from utilities are also examined. Information from the alcohol production evaluation, energy survey, biomass profile, and power production analysis is integrated in the final chapter, and an overall energy management plan is defined.

56456 Gasohol from wood wastes shows promise. *Design News;* 37: No. 18, 29(21 Sep 1981).

Researchers at Georgia Tech's Engineering Experiment Station are getting a wood waste conversion rate of about 80% when converting cellulose to sugar, which is then fermented into alcohol. Wood shavings, sawdust, fallen branches and trees unsuitable for lumber are used to produce ethanol. Tests of the technology will be undertaken when a small ethanol plant is built. If successful, the process could be ready for commercial use in several years.

56457 Raw materials evaluation and process development studies for conversion of biomass to sugars and ethanol. Wilke, C.R.; Yang, R.D.; Sciamanna, A.F.; Freitas, R.P. (Univ. of California, Berkeley). *Biotechnology and Bioengineering;* 23: No. 1, 163-183(Jan 1981).

A range of cellulosic raw materials in the form of agricultural crop residue was analyzed for chemical composition and assessed for potential yields of sugars through chemical pretreatment and enzymatic hydrolysis of these materials. Corn stover was used as a representative raw material for a preliminary process design and economic assessment of the production of sugars and ethanol. With the process as presently developed, 24 gal ethanol can be obtained per ton of corn stover at a processing cost of about /1.80/gal exclusive of by-product credits. The analysis shows the costs of ethanol to be highly dependent upon: 1) the cost of the biomass, 2) the extent of conversion to glucose, 3) enzyme recovery and production cost, and 4) potential utilization of xylose. Significant cost reduction appears possible through further research in these directions. 14 refs.

56458 On the disruptive burning of free droplets of alcohol/n-paraffin solutions and emulsions. Lasheras, J.C.; Fernandez-Pello, A.C.; Dryer, F.L. (Princeton Univ, NJ). *Symposium (International) on Combustion,* [*Proceedings*]*;* 293-305(1980). (CONF-800809—).

From 18. combustion symposium; Waterloo, Canada (17 Aug 1980).

A systematic experimental study of the low Reynolds number, atmospheric pressure combustion of free droplets of binary n-propanol/n-paraffin solutions and ethanol/n-paraffin solutions and emulsions was performed. Special attention was given to the characterizing the disruptive burning phenomena for these fuel systems. The onset of disruptive burning was shown to be a function of both the difference between the normal boiling points and relative concentration of the solution components. Disruptive burning was found to be the result of homogeneous bubble nucleation within the interior of the droplet followed by the expansion and bursting of the gaseous nucleus. All ethanol/n-paraffin emulsions studied exhibited disruptive combustion behavior typical of solutions. This was attributed to dissolution of the dispersed phase during the transient heating period. 18 refs.

0903 Inorganic Hydrogen Compound Fuels

REFER ALSO TO CITATION(S) 57698

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 56490, 56526, 56527, 56538, 56650, 56651, 57272, 58225

56459 (AD-A—111376/0) Economic model of future coal/densified refuse-derived fuel use at Wright-Patterson AFB, Ohio. Master's thesis. Fedors, R.G. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1981. 201p. (AFIT-LSSR—97-81). NTIS, PC A10/MF A01.

The use of alternate fuels in heating and power plants is one activity supporting Air Force long-range objectives to become more energy efficient and reduce dependency on petroleum products. Within the solid fuel conversion effort, goals have been set for increasing the percentage of total installation energy provided by coal and its products, refuse-derived fuels, biomass, and wood. To encourage development of alternate fuel use and gain operating experience, WPAFB undertook a thirty-month evaluation/demonstration of dRDF as a stoker boiler fuel in military heating plants (starting in May, 1979). This thesis examines the impact on plant operating expenses of burning coal:dRDF mixtures at that particular base. The figures for comparison were generated by a simulation model of the WPAFB heating system and environment. Projected yearly operating expenses were accumulated in the model and returned to present values for various fuel ratios, inflation rates, and discount factors. Under the assumptions made within the model, coal alone will remain less expensive to use than a mixture with dRDF until a local source of dRDF becomes available.

56460 (EUR—7558-DE) Development of a plant producing heat, mechanical and electrical energy by gasification of wood and straw in a 50 to 150 kW gasifier - 'gasification of pieces of biomass with efficiencies between 150 and 400 kW - design and construction of an experimental gasifier'. Ide, H.; Zerbin, W.O.; Linneborn, H.; Lohmann, J. (Commission of the European Communities, Brussels (Belgium)). 1981. 58p. (In German). Commission of the European Communities, Brussels, Belgium.

The gasification of wood and straw in the piece-gasifier is described under atmospheric pressure with air for heat producing and winning mechanical or electrical energy with outputs of 50-150 kW and 150-400 kW. While studying the fundamental questions of utilization, production, cooling and cleaning of generator gas and preparing and charging the solid fuel for gasification, also the development of generators with higher gas production was a central point. It appeared advantageous to increase the flexibility and operative range of the generators and restrict through that the number of generator types. Under this aspect, 3 types of bigger generators with a gas output of 320, 670 and 1.110 Nm^3/h for the range 150-400 kW were planed and constructed. A lot of research was done on these new generators. About ten gas engines (partly self-prepared for generator gas) served as test plants.

56461 (EUR—7686-DE) Energy production from cereal straw. Strehler, A.; Hofstetter, E.M.; Heins, F. (Commission of the European Communities, Luxembourg). 1982. 320p. Commission of the European Communities, Luxembourg.

Surplus straw represents for agriculture a significant energy potential which could replace even 70% of the now needed fuel oil when only 20% of the straw production is utilized. The utilization of straw as a source of energy, however, requires an efficient technology which has to meet the legal regulations for emmission limitation, and must work safely at a low labour input and which must be applicable in an economically reasonable way. Most of the investigations and developments on which this research project is based, had the aim of developing an adequate technology. The definition of combustion technological basic dates as calorific value, specific volume of flue gas, chemical composition, contents of volatile compounds an pure coke was the basis of the work. Besides the correlation between the calorific value and conditions of storage and moisture contents was defined. The checking and valuation of different straw combustion systems represented an essential part of the research work. We also made some developments of plants and furnaces of our own, which resulted in a furnace with automatic feeding of fuel as chopped wood and straw. Various systems of untying bales and fuel supply were checked. The different possibilities of chopping straw were tried out in action. In an investigation also the possibilities of gasifying straw were checked. Another investigation dealt with the issue of energy production from straw, from the electrification of the single farm up to a straw power plant for 50 MW. One study investigates the demand of energy and the possibilities of energysupply with straw and woodwaste, in order to work out proposals for some regions.

56462 Combustion of pyrolysis char and liquefaction bottoms. Lin, C.J.; Winegartner, E.C. (Exxon Res & Eng Co, Baytown, Tex). pp 21p, Paper No. CSS/CI-80-15 of Combustion Institute, Central States Section, spring meeting, 1980. Baton Rouge, LA; Combustion Institute (1980).

From Spring meeting of the Combustion Institute Central States section; Baton Rouge, LA, USA (24 Mar 1980).

The handling and combustion characteristics of pyrolysis char and liquefaction bottoms were investigated in a laboratory furnace having a controlled wall temperature. The furnace was designed to burn pulverized fuels at nominal rates of 5 to 10 lb/hr, and is capable of duplicating the time and temperature history of the burning fuel in large commercial boilers. The reactivities of solid fuels and the flame stabilities were assessed by burning the fuel in the laboratory furnace at decreasing wall temperatures. 6 refs.

13 HYDRO ENERGY

1301 Resources And Availability

56463 (AD-A—109762/5) Reservoir storage determination by computer simulation of flood control and conservation systems. Technical paper. Eichert, B.S. (Hydrologic Engineering Center, Davis, CA (USA)). Oct 1979. 15p. NTIS, PC A02/MF A01.

The paper presents ways that a comprehensive simulation computer program (HEC-5) can be used in planning a water resources system composed primarily of multipupose reservoirs with flood control as a major project purpose. In addition, techniques for determining reservoir storage requirements for flood control, water supply and hydropower are presented.

56464 (AD-A—109787/2) Potential energy and capacity gains from flood control storage reallocation at existing U.S. hydropower reservoirs. Technical paper. Eichert, B.S.; Bonner, V.R. (Hydrologic Engineering Center, Davis, CA (USA)). Jun 1981. 26p. NTIS, PC A03/MF A01.

This paper describes the procedures and results of an investigation to evaluate potential increases in nationwide hydropower production that could be achieved by reallocation of flood control storage at existing hydropower reservoirs. One aspect of the investigation considered only the increase in energy that could be achieved by storage reallocation; a second aspect considered potential gains in both energy and capacity that could be achieved by adding to the existing installed capacity as well as storage reallocation. The investigation was performed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers, and is a component of a technical overview study which is part of the National Hydropower Study.

56465 (AD-A—109788/0) Use of non-sequential techniques in the analysis of power potential at storage projects. Technical paper. Franc, G.M. (Hydrologic Engineering Center, Davis, CA (USA)). Jun 1981. 19p. NTIS, PC A02/MF A01.

An electronic computer procedure is described that uses an estimate of power storage available at a dam site to make estimates of average annual energy and dependable capacity using a non-sequential methodology. Comparisons of this method against the more traditional sequential routing analysis are performed.

1303 Plant Design And Operation

56466 (AD-A—109772/4) Potential for increasing the output of existing hydroelectric plants. Technical paper. Davis, D.W.; Buckley, J.J. (Hydrologic Engineering Center, Davis, CA (USA)). Jun 1981. 26p. NTIS, PC A03/MF A01.

The potential for increasing power output both through physical improvements in generating equipment and by changes in the manner that existing projects are operated were investigated and estimates of power increase prepared. The investigation was nationwide in scope, including Hawaii, Alaska, and Puerto Rico. All existing hydroelectric plants, regardless of ownership, were investigated for improvement in power output. The potential is identified by the type of improvement and is reported as aggregate regional values and national summaries.

1305 Economics And Management

REFER ALSO TO CITATION(S) 56463, 56464

56467 (AD-A—109757/5) Technical factors in small hydropower planning. Technical paper. Davis, D.W. (Hydrologic Engineering Center, Davis, CA (USA)). Feb 1979. 43p. NTIS, PC A03/MF A01.

The Hydrologic Engineering Center, Corps of Engineers, is preparing a document entitled 'Manual for the Determination of the Feasibility of Adding Small Hydroelectric Power to an Existing Facility.' The manual is designed for use by public agencies (federal, state and local), public and private utilities, and private investors. It focuses upon the concepts, technology, and economic and financial issues unique to small hydropower additions. This paper discusses issues related to engineering and economic considerations in planning small hydropower additions, presents an overview of significant findings of the investigation to data, and provides a status report on manual preparation.

56468 (AD-A—109761/7) Feasibility analysis in small hydropower planning. Technical paper. Davis, D.W.; Smith, B.W. (Hydrologic Engineering Center, Davis, CA (USA)). Aug 1979. 27p. NTIS, PC A03/MF A01.

The Hydrologic Engineering Center, Corps of Engineers, has prepared a manual entitled 'Feasibility Studies for Small Scale Hydropower Additions'. The manual provides technical data and procedural guidance for the systematic appraisal of the viability of potential small hydropower additions and focuses upon the concepts, technology, and economic and financial issues unique to these additions. This paper presents the significant findings and conclusions that became evident from the studies performed during preparation of the manual.

56469 (NYSERDA—80-10) Hydropower utilization in New York State. Brown, R.S.; Goodman, A.S. (Polytechnic Inst. of New York, Brooklyn (USA)). Sep 1980. 96p. NTIS, PC A05/MF A01. Order Number DE82902513.

The impact of New York State government's policies upon the climate of the small-scale hydropower marketplace has been increasingly evident. New York Stae has already seen $225 to 250 million committed to small-scale hydropower projects (225 MW) by mid-1979. Based on the calculations presented in this report, the overall market could be approximately $1.0 billion for a capacity of 1129 MW at a cost of less than 5 cents/kWh. This figure will rise dramatically to $2.4 billion for an additional capacity of 980 MW at a cost of less than 10 cents/kWh. This is 10 times the publicly known present commitment to small hydropower development. The success of programs designed to activate this overall marketplace during the next several years will depend heavily on political and economic factors. Innovative policies can create opportunities to fully utilize the small-scale hydropower resources in all parts of the state.

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 58173

14 SOLAR ENERGY

1403 Economics

56470 (ED—194075) Evaluation of television as a method of disseminating solar energy information. Edington, E.D. (New Mexico State Univ., Las Cruces (USA). Bureau of Educational Research). Aug 1980. 194p. ERIC Document Reproduction Service (Computer Microfilm International Corporation), Arlington, VA 22210.

This project included three separate studies undertaken to determine the effectiveness of television instruction as a method of effectively delivering information about solar energy systems to present and future workers in related industries, and as a method of delivery for adult continuing education instruction. All three studies used a series of five half-hour videotapes. A survey of the general public in the Las Cruces area was conducted to determine the number and occupational status of people watching the series on a local public broadcasting station. Surveys of random samples then assessed the prior level of knowledge on solar energy of residents from differing socioeconomic strata and any increase in knowledge after viewing the series. The worker study included apprentices, journeymen sheet metal workers, and materials handlers. These workers were given a pretest, shown the television series, and given a posttest. The relative effectiveness of television and regular instruction were compared in solar energy related vocational classes at two postsecondary institutions, and student attitudes concerning television instruction were assessed.

1401 Resources And Availability

56471 (NP—2906405) Solar in Arizona. (Arizona Solar Energy Commission, Phoenix (USA)). Jan 1982. 213p. Arizona Solar Energy Commission, 1700 W. Washington, No. 502, Phoenix, AZ 85007.

The following publications of the Arizona Solar Energy Commission are included: Annual Report 1980-1981, Solar Energy Plan, Arizona's Solar Laws and Rules, Arizona's Solar Energy Tax Credits, Selling Solar in Arizona, Arizona Solar Industries Guide 1982-1983, and Bibliography of Publications.

56472 (SERI/SP—281-1658) Direct normal solar radiation data manual: long-term, monthly mean, daily totals for 235 National Weather Service Stations. Addendum to the Insolation Data Manual. Knapp, C.L.; Stoffel, T.L. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1982. Contract AC02-77CH00178. 87p. NTIS, PC A05/MF A01. Order Number DE82020377.

Average monthly data are presented that depict the long-term geographic distribution of direct normal solar radiation in the US. Some terms are defined, the ADIPA model for estimating hourly direct normal insolation is described, and its validation is discussed. Direct normal radiation is then tabulated for 235 National Weather Service Stations, given as monthly and annual averages in units of kJ/m^2-day, Btu/ft^2-day, and kWh/m^2-day. Direct normal solar radiation contour maps are then given for each month, and station histories are tabulated giving the station location and number, latitude, longitude, elevation, and period recorded. (LEW)

56473 (SERI/TP—215-1636) Imaging radiometry systems. Cannon, T.W. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1982. Contract AC02-77CH00178. 15p. NTIS, PC A02/MF A01. Order Number DE82015862.

Portions of document are illegible.

Imaging radiometry systems are used to measure the spatial distribution of radiant energy. An overview is given of television camera tubes, solid state camera detectors and pyroelectric imaging detectors usable in these systems. Some comments about system parameters which must be considered in development of imaging radiometers are included. As an example, a solar flux mapper used for mapping all-sky luminance, inner-model luminance, and focused flux irradiance is described; examples of the data are given.

REFER ALSO TO CITATION(S) 56051, 56558

56474 (ATR—82-7981-02-1) Third-party financing of central-receiver repowering projects. Munjal, P.K.; Walter, J.; Mathur, P.N. (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Dec 1981. Contract AC03-81SF11514. 27p. NTIS, PC A03/MF A01. Order Number DE82016190.

An innovative third party financing approach for the first solar thermal repowering plants is investigated that may reduce the need for direct DOE cost sharing during the early application of central receiver technology by industry. Third party refers to a corporation, partnership, or a joint venture that can take advantage of existing financial incentives. The available financial incentives are summarized, including the guaranteed market for central receiver power provided by Section 210 of the Public Utility Regulatory Policy Act, and federal and state tax credits and depreciation schedules. The economics of third party central receiver repowering plant financing is analyzed, and the case history of the Arizona Public Service Utility Saguaro Plant No. 1 is used as an example. Finally, a sensitivity analysis examines the effects of variations of different financial parameters on the return on investment. It is found that a substantial portion of investment equity can be recovered in the first few years of plant operation, and good future years cash flows appear possible. Third party financing appears capable of helping stimulate mass production of heliostats and a rapid transfer of central receiver technology to utilities and industry, with attending economic benefits. (LEW)

56475 (DOE/ET/20154—T3) Analysis of investment alternatives to stimulate development and technology transfer for energy technologies. Solar photovoltaics. A case study. (TRW Energy Systems Planning Div., McLean, VA (USA)). Sep 1978. Contract AC05-78ET20154. 143p. NTIS, PC A07/MF A01. Order Number DE82013946.

Portions of document are illegible.

Government incentives to accelerate commercial application of terrestrial photovoltaic systems are identified and evaluated. Six types of incentives were analyzed by simulating the analysis a typical manufacturer might conduct in order to decide how to respond to the particular incentive. The first incentive is direct government procurement, in which the government enters into a contract with one or more manufacturers which guarantees annual purchase of a certain amount for a predetermined number of years, priced according to a predetermined schedule. The second incentive, modified direct government procurement, is similar to the first, except that the manufacturer has the option of terminating participation in the program prior to contract expiration. The third incentive, fixed price buy, is an alternative form of a multiyear procurement incentive in which the buy price remains fixed for the duration of the procurement. The remaining three incentives are capital subsidies, increased investment tax credits, and enhanced depreciation allowances. The analysis performed by a potential manufacturer of photovoltaic arrays to ascertain the feasibility of building a manufacturing facility given implementation of each incentive is simulated. The company decision process is analyzed; the most likely options available to a potential array manufacturer after enactment of an incentive program are described and analyzed in an illustrative case. The impact of balance-of-system costs on photovoltaic commercialization potential was analyzed. The present nature of the emerging photovoltaic industry in the United States is examined, and the impact of incentives on future industry competitiveness is described. (LEW)

56476 (PB—82-171570) Competition in the photovoltaics industry: a question of balance. Final report. Stambler, B.; Stambler, L. (Center for Renewable Resources, Washington, DC (USA)). 1 Feb 1982. 227p. NTIS, PC A11/MF A01.

The focus of this report is on a technology that is tremendously flexible and that can provide energy efficiently in remote areas. Photovoltaics are also a potential source of inexpensive electricity for residential use. Solar cells represent one of many renewable energy resources and technologies that must be developed if the United States is to reduce its dependence on scarce and expensive fossil fuels.

56477 (SAND—81-7047) Photovoltaic subsystem marketing and distribution model. (Barry (Theodore) and Associates, Los Angeles, CA (USA)). Apr 1982. Contract AC04-76DP00789. 90p. NTIS, PC A05/MF A01. Order Number DE82015783.

The purpose of the marketing and distribution model is to estimate the costs of selling and transporting photovoltaic solar energy products from the factory to the factory customer. The model adjusts for inflation and regional differences in marketing and distribution costs. The model consists of three major components: the marketing submodel, the distribution submodel, and the financial submodel. What the model can and cannot do, and what data are required is explained. An example for a power conditioning unit demonstrates the application of the model.

56478 (SAND—82-8030) Solar-thermal-industry status and future needs. Radosevich, L.G. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1982. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01. Order Number DE82020885.

Examined are the state of the solar thermal industry and its needs for the future. Information from a recent survey of industrial firms, a description of industry's research and development needs as stated through the Solar Thermal Energy Association, and a summary of private initiatives are presented.

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 56051, 56475, 56504

56479 (DE—81-030310) Standards application and development plan for solar thermal technologies. Cobb, H.R.W. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. 218p. NTIS, PC A10/MF A01.

Functional and standards matrices, developed from input from ST users and from the industry that will be continually reviewed and updated as commercial aspects develop are presented. The matrices highlight codes, standards, test methods, functions and definitions that need to be developed. They will be submitted through ANSI for development by national consensus bodies. A contingency action is proposed for standards development if specific input is lacking at the committee level or if early development of a standard would hasten commercialization or gain needed jurisdictional acceptance.

56480 (ORNL/TM—7873) Whole-tree harvesting: first year progress report. Impacts on productivity and nutrient change. Mann, L.K.; West, D.C. (Oak Ridge National Lab., TN (USA)). Dec 1981. Contract W-7405-ENG-26. 38p. NTIS, PC A03/MF A01. Order Number DE82007473.

Portions of document are illegible.

Scientists at Oak Ridge National Laboratory are coordinating investigations on the environmental effects of residue removal and whole-tree utilization for several forest types in the United States. Sites were selected to include northern hardwood, northern coniferous, southern appalachian oak-hickory, northwestern coniferous, and southern pine forests. All sites were established at locations with a long history of biomass and nutrient cycling research to provide a foundation of data to assess whole-tree harvesting effects. The overall program plan is to assess the effects of whole-tree harvest on erosion, nutrients, water quality, and productivity. This report (the first in a series) describes the sites and sampling procedures and reports some preliminary data. Researchers at all sites plan to estimate or measure biomass, vegetation nutrient concentrations, litter nutrient pools, soil nutrients (available and total), system losses and inputs (including gaseous, particulate, and water transported), and fluxes among these components over the duration of stand harvest rotation.

56481 (PB—82-159930) Solar energy domestic policy review international panel review of existing federal programs. (Agency for International Development, Washington, DC (USA)). Sep 1978. 115p. NTIS, PC A06/MF A01.

This international panel report reviews recent international solar activities of U.S. agencies, especially those of A.I.D., the Department of Energy (DOE), Department of Commerce (DOC), and the International Energy Department Program (IEDP), as well as the major legislative authorities for them.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 56448, 56449, 56453, 56454, 56455, 56456, 56457, 56460, 56461, 56476, 56569, 56591, 56650, 56651, 57110, 57129, 57697, 57698

56482 (AD-A—109477/0) Design of semiconductor photoelectrochemical systems for solar energy conversion. Technical report. Bard, A.J. (Texas Univ., Austin (USA). Dept. of Chemistry). 21 Dec 1981. 34p. NTIS, PC A03/MF A01.

The principles and applications of semiconductor electrodes in photoelectrochemical (PEC) cells for carrying out useful chemical reactions are described. The factors in the design of efficient and stable systems and semiconductor particulate systems constructed on the basis of PEC cell principles are discussed.

56483 (AD-A—109701/3) Characterization of trapping states in semiconductors. Final report 1980-1981. Hopkins, H.S. (Naval Academy, Annapolis, MD). 2 Jun 1981. 102p. (USNA-TSPR—111). NTIS, PC A06/MF A01.

Defect energy states within the band gap are known to affect the performance of semiconductors in terms of response time. The characterization of defects is the first step in understanding how they act and how one may use them to benefit diode performance. Characterization of a defect includes among other quantities, the energy difference from the band edge, and the capture cross section of the energy state. Deep Level Transient Spectroscopy (DLTS) is a very powerful experimental method using the transient capacitance properties reverse-biased p-n junction diodes to characterize defects. A particular electron trap in n-type GaAlAs, known as the DX center is studied in this report using two different DLTS experimental setups. A complex model is proposed for the DX center consisting of a group plus an excited state with independent capture cross sections and communication between the two levels. Since classical analysis of DLTS data yields misleading results when a complex trap is considered, a computer simulation and curve fitting technique was used to determine the trap structure and parameters. This technique gave values of .295 eV for the ground state energy, .219 eV for the excited state, prefactor values on the ground, excited, and communication prefactor of 1.02 x 10 to the 7th, 2.2 x 10 to the 8th and 5.58 x 10 to the 5th, respectively.

56484 (AD-A—110006/4) Semiconductor electrodes. 43. The effect of light intensity and iodine doping on the stabilization of n-silicon by phthalocyanine films. Technical report. Leempoel, P.; Castro-Acuna, M.; Fan, F.F.; Bard, A.J. (Texas Univ., Austin (USA). Dept. of Chemistry). 21 Dec 1981. 30p. NTIS, PC A03/MF A01.

56485 (AD-A—111135/0) Photoluminescence study of ion implantation damage in gallium arsenide. Master's thesis. Key, M.V. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1981. 84p. NTIS, PC A05/MF A01.

The 5 deg photoluminescence (PL) from 1.55 eV to 1.36 eV of semi-insulating bulk GaAs implanted with Si was observed, using the 488 nm line of an argon-ion laser. Implant dosages were 10 to the 12th power, 10 to the 13th power, 10 to the 14th power, and 10 to the 15th power ions/sq cm. Separate sets of samples were annealed at 750 deg C and 900 deg C. The virgin unannealed sample spectrum contained a shallow donor peak at 1.513 eV, a carbon donor-to-carbon acceptor peak at 1.490 eV, a possible carbon donor-to-zinc acceptor peak at 1.487 eV, and an optical phonon peak at 1.454 eV. The virgin annealed sample spectra included, additionally, a vacancy complex-to-silicon acceptor peak at 1.406 eV, a Ga vacancy complex peak at 1.358 eV and a phonon replica at 1.322 eV. The spectra of the implanted unannealed samples showed an increasing quenching of native peaks with increasing dosage, and included no new damage related peaks. The spectra of the implanted samples showed an increase in the native peaks due to annealing but not due to Si dosage increases. The increase in Si dosage caused an increase in low energy broad peaks. A temperature study (5 deg K to 77 deg K), and chemical etching depth resolved study of a sample implanated with 10 to the 15th power ions sq cm and annealed at 900 deg C showed two broads peaks: one near 1.38 eV and one near 1.42 eV.

56486 (AD-A—111174/9) Theoretical analysis of an AlGaAs/AlGaAs heteroface back-barrier solar cell. Master's thesis. Miazza, D.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1981. 72p. NTIS, PC A04/MF A01.

A solar cell with a high band gap window, a homojunction, and a back-barrier on a base has been analyzed theoretically under fairly general conditions. The carrier transport equations were solved to obtain the short circuit current density. The theoretical results are applicable to similarly structured cells made from other materials. Although there is a lack of data on the properties of AlGaAs, many of the properties of AlGaAs have been modeled in this report by drawing on the work of others. The AlGaAs solar cell was modeled on a computer and certain design parameters (such as Al content) varied in order to examine their effects.

56487 (ANL/EES-TM—187) Ethanol production via fungal decomposition and fermentation of biomass. Semiannual progress report, October 1981-March 1982. Antonopoulos, A.A.; Wene, E.G. (Argonne National Lab., IL (USA)). Apr 1982. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01. Order Number DE82020401.

During the first half of FY 1982, a few additional Fusarium isolates were obtained and screened for their cellulolytic and fermenting abilities. Experiments with an isolate from Fusarium strain ANL 22-760 showed that cellulose was the best inducer of FPase and CMCase, while glucose, lactose, and xylose almost completely inhibited cellulase production. Tests with Fusarium strain ANL 11182 indicated that a cellulase production of 2.5 IU/mL in 14 days was obtained at 28°C in a medium of 1% cellulose and in the presence of 0.7 mg/mL extracellular protein. Increasing the nitrogen content of the medium stimulated cell growth but decreased cellulase production. The ratio of CMCase to FPase remained nearly constant at about 10:1 during fermentations with varying concentrations of cellulose and nitrogen sources. Several of the new isolates and mutants, when screened for their fermenting ability in glucose, produced ethanol at a conversion efficiency close to that achieved in yeast fermentations. Fermentations of 1% glucose by isolates from strain ANL 99A-78 repeatedly produced 4.3 mg/mL ehtanol within 48 hours. A few of the new isolates and mutants produced, in consecutive fermentations of 1% xylose, up to 4.2 mg/mL ethanol within 48 hours. Addition of glucose to higher concentrations of xylose increased the yield of ethanol.

56488 (BSDF—39-8Q-81) Technical and economic feasibility of membrane technology. Final report, September 17, 1979-November 16, 1981. (Beet Sugar Development Foundation, Fort Collins, CO (USA); American Crystal Sugar Co., Moorhead, MI. Research Center). 1981. Contract AC03-79CS40213. 50p. NTIS, PC A03/MF A01. Order Number DE82019045.

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The first phase of the project involved the development of a literature survey relative to the state-of-the-art for reverse osmosis (RO), electrodialysis (ED), and ultra filtration (UF). A comprehensive examination of both domestic and foreign literature provided a basis for selection of membrane candidates evaluated in Phase II and III of the project. In addition, an investigation was conducted identifying the development of other commercial membrane materials for use other than in the sugar industry (cheese industry). During Phase II, selected membranes were evaluated using a prototype mounting configuration, different temperatures, pressures, feed streams as well as some preliminary testing on ED and UF. The feed streams evaluated included diffusion juice, thin juice, hot Steffan waste, and ion exchanged purified effluents. Replicated runs were performed on several different batches of membranes and feeds to establish significant differences. The activity conducted during Phase III consisted of evaluating selected membranes over a long-term performance basis, i.e., pilot plant evaluation. Membrane material were mounted in pilot hardware for testing purposes. Determinations of membrane life cycles were made as well as establishing the preliminary economics of the operation as related to replacement module service life and on-line operating characteristics.

56489 **(CONF-820730—1) Summary of biomass research programs at Oak Ridge National Laboratory.** Genung, R.K.; Van Hook, R.I.; Bjornstad, D.J. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE82018169.

From TVA southeast region biomass research conference; Muscle Shoals, AL, USA (12 Jul 1982).

Biomass activities are described under the following topics: production, conversion, and economic and market analyses of biomass usage.

56490 **(DOE/CS/30166—T58) Wood energy information guide: a self-help information package for potential wood-fuel users.** Pulaski, E.C.; Karmous, M.K.; Jahn, L.G.; Wainwright, P.B. (Southern Solar Energy Center, Atlanta, GA (USA); North Carolina State Univ., Raleigh (USA). Industrial Extension Service). 1981. Contract AC02-79CS30166. 92p. NTIS, PC A05/MF A01 - Publications, Industrial Extension Service, Box 1125, New Bern, NC 28560 $6.00. Order Number DE82020161.

This Self-Help Information Package is intended as a guide for potential wood fuel users. Topics are included on wood resources, handling and combustion equipment, combustion techniques, environmental considerations, and economics.

56491 **(DOE/ER/70067—T1) Electrolytic deposition of low-cost, high-purity polysilicon suitable for use in solar-cell devices. Final technical report.** Feigelson, R.S. (Stanford Univ., CA (USA). Center for Materials Research). Mar 1982. Contract AT03-76ER70067. 39p. (CMR—81-16). NTIS, PC A03/MF A01. Order Number DE82012428.

Two processes have been developed for the commercial production of low cost solar silicon. In the first, silicon is deposited at about 745°C onto a graphite substrate from a solution of K_2SiF_6 in the binary KF/LiF or ternary LiF/NaF/KF entectic. The second process involves the deposition of silicon at temperatures above its melting point. Electrodeposition of silicon in the form of coherent, inclusion-free film was achieved, and a 99.999% purity level was attained. An average grain size over 100 microns was attained in films 100 to 200 microns thick, with good film uniformity and good carrier mobility. Electrodeposition of silicon above its melting point was attained at very rapid deposition rates. The purity of this material was close to that required for a source material for pulling or casting of crystals for solar cells. (LEW)

56492 **(DOE/ET/20279—188) Materials, Processes, and Testing Laboratory, final report summarizing module performance at MIT Lincoln Laboratory experimental photovoltaic test sites, 1977-1982.** Forman, S.E.; Themelis, M.P. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Jun 1982. Contract AC02-76ET20279. 42p. NTIS, PC A03/MF A01. Order Number DE82020699.

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During the years 1977 to 1982 over 11,000 photovoltaic (PV) modules were placed at experimental PV power-generating systems in a number of field test sites in the United States. Prominent among these are a 100-kW system at Natural Bridges National Monument in Utah, a 25-kW system at Mead, Nebraska, and a 15-kW system at Bryan, Ohio. Through a program of periodic surveillance, measurements and inspections at the aforementioned sites, 470 electrically failed modules were located, removed and analyzed during this six-year period. The principal causes of failure were: (1) cells cracked due to weathering or internal module stresses; (2) failed solder joints: (3) interconnects not soldered to rear sides of cells at assembly; (4) cells or interconnects electrically shorted to metallic substrates; and (5) broken or split interconnects. Details and photographs of many of the different types of failures are presented. In addition, some of the analysis techniques used to locate the failures are described.

56493 **(DOE/JPL—1012-69) Investigation of the effect of wind cooling on photovoltaic arrays.** Wen, L. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1982. Contract AI01-76ET20356. 50p. (JPL-PUBL—82-28). NTIS, PC A03/MF A01. Order Number DE82020464.

Convective cooling of photovoltaic modules is investigated for different wind conditions, including steady-state controlled testing in a solar simulator and natural test environments in a field. Analytical thermal models of different module designs were used to correlate experimental data. The results obtained in the controlled environment confirm the applicability of existing heat-transfer correlations. The results of long-term field testing at the Jet Propulsion Laboratory test site is not conclusive because wind conditions were measured at different heights than that of the modules. Nevertheless, reasonable agreement can be obtained by applying a power-law wind profile.

56494 **(DOE/JPL/955843—82/5) Large-area sheet task: advanced dendritic web growth development. Quarterly report, October 24, 1981-December 31, 1981.** Duncan, C.S.; Seidensticker, R.G.; McHugh, J.P.; Hopkins, R.H.; Meier, D.; Schruben, J. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 18 Jun 1982. Contract NAS-7-100-955843. 21p. NTIS, PC A02/MF A01. Order Number DE82020310.

During this quarter, the thermal stress model was used to generate the design of a low-stress lid and shield configuration, which was fabricated and tested experimentally. The results agreed with the predictions of the buckling model and crystals were grown to a width of 49.9 mm. In preliminary tests, the New Experimental Web Growth Facility performed as designed, producing web on the first run. These experiments suggested desirable design modifications in the melt level sensing system to improve further its performance, and these are being implemented.

56495 **(DOE/JPL/956061—4) Flat-plate solar array project. Task I. Silicon material: investigation of the hydrochlorination of $SiCL_4$. Quarterly report, April 9, 1982-July 8, 1982.** Mui, J.Y.P. (Solarelectronics, Inc., Bellingham, MA (USA)). 12 Jul 1982. Contract NAS-7-100-956061. 37p. NTIS, PC A03/MF A01. Order Number DE82020508.

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A basic research oriented experimental study on the effect of pressure on the hydrochlorination of $SiCl_4$ was carried out. Reaction kinetic measurements on the hydrochlorination of $SiCl_4$ and metallurgical grade (m.g.) silicon metal were made at a wide range of experimental variables. The effects of pressure on the reaction rate was studied. As expected, higher pressures produce a higher equilibrium $SiHCl_3$ conversion, since the hydrochlorination reaction results in a net volume contraction as product $SiHCl_3$ is formed. However, the reaction rate, namely, the rate at which the hydrochlorination reaction reaches its equilibrium $SiHCl_3$ conversion, was found to be much faster at low pressures. Reaction kinetic measurements were also carried out at a low pressure of 100 psig as a function of temperatures and $H_2/SiCl_4$ feed ratios. A higher reaction temperature produces both a faster reaction rate and a higher equilibrium $SiHCl_3$ conversion. A higher $H_2/SiCl_4$ feed ratio results a higher partial pressure of hydrogen gas in the hydrochlorination reactor. Thus, the higher partial pressure of hydrogen will drive the equilibrium reaction to produce more $SiHCl_3$. The variable $H_2/SiCl_4$ feed ratios do not appear to significantly effect the rate of the hydrochlorination reaction. The SEM analysis on the Alloy 400 test sample provides further experimental evidences on the corrosion mechanism of metal alloys in the hydrochlorination reaction environment.

56496 **(DOE/RA/50121—T1) Quarterly report No. 3 in support of Heber Ethanol Fuel Facility, Imperial Valley, California. Quarters 3 and 4, June 1981-November 1981.** (VTN Consolidated, Inc., Irvine, CA (USA)). Feb 1982. Contract RA03-80RA50121. 140p. NTIS, PC A07/MF A01. Order Number DE82016607.

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The analysis of feedstock supply discusses various potential feedstocks and gives a rationale for choosing corn. Potential transportation modes are discussed and a rationale for choosing rail is given. Potential pricing considerations and a statistical approach to predicting future corn prices are included. A preliminary marketing plan is presented. An overview of the current market and a situation analysis, the scope of the marketing program, and a general plan are included. An environmental analysis, a financial analysis, and a sensitivity analysis are presented.

56497 **(DOE/RA/50323—1-Vol.1-Exec.Summ.) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume I. Executive summary.** (Hilo Coast Processing Co., Pepeekeo, HI (USA); Brewer (C.) and Co. Ltd., Honolulu, HI (USA)). May 1981. Contract FG07-80RA50323. 118p. NTIS, PC A06/MF A01. Order Number DE82018280.

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The following aspects of the 11.4 million gallon ethanol-from-molasses plant are summarized: background, findings, study method, economic analysis, financing, market study, raw materials, energy sources, process design, definitive engineering, bid estimate, and project schedules.

56498 **(DOE/RA/50323—1-Vol.2) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume II. Process design.** Messick, J.R.; Kaupisch, K.F.; Yeats, C.; Hicks, H.W.; Wagner, R.C.; Moon, G.D. Jr.; Katzen, R. (Hilo Coast Processing Co., Pepeekeo, HI (USA); Katzen (Raphael) Associates, Cincinnati, OH (USA)). May 1981. Contract FG07-80RA50323. 103p. NTIS, PC A06/MF A01. Order Number DE82018289.

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The process design engineering requirements for production of Motor Fuel Grade alcohol at the HCPC sugar plantation are presented. The following are covered: background, scope of work, design basis, process description, operating parameters, and process diagrams.

56499 **(DOE/RA/50323—1-Vol.3) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel grade ethanol plant. Volume III. Process design.** Messick, J.R.; Kaupisch, K.F.; Yeats, C.; Hicks, H.W.; Wagner, R.C.; Moon, G.D.; Katzen, R. (Hilo Coast Processing Co., Pepeekeo, HI (USA); Katzen (Raphael) Associates, Cincinnati, OH (USA)). May 1981. Contract FG07-80RA50323. 222p. NTIS, PC A10/MF A01. Order Number DE82018296.

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This volume of the process design package contains the following: equipment and instrument specifications, line list and specifications, and piping and valve specifications.

56500 **(DOE/RA/50323—1-Vol.5) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume V. Definitive engineering.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). May 1981. Contract FG07-80RA50323. 275p. NTIS (US Sales Only). Order Number DE82018301.

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The following engineering details are included: drawing list, plot plans, equipment arrangement drawings, process flow diagrams, piping and instrument diagrams, civil drawings, architectural drawings, electrical drawings, structural drawings, piping material specification, line list, instrument index, and professional services.

56501 **(DOE/RA/50323—1-Vol.6) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume VI. Definitive engineering.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). May 1981. Contract FG07-80RA50323. 454p. NTIS (US Sales Only). Order Number DE82018760.

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The following engineering data are included: equipment index and list, specification index, equipment specifications, electrical specifications, and bid summaries.

56502 **(DOE/RA/50323—1-Vol.7) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume VII. Budget estimate.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). May 1981. Contract FG07-80RA50323. 288p. NTIS (US Sales Only). Order Number DE82019329.

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The budget estimate includes the following: the basis of estimate, the code of accounts, summary, equipment, material, proratables, engineering, escalation, and equipment cost estimates for raw materials receiving and storage, molasses pre-treatment and clarification, and fermentation.

56503 **(DOE/RA/50323—1-Vol.8) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume VIII. Budget estimate.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). May 1981. Contract FG07-80RA50323. 263p. NTIS (US Sales Only). Order Number DE82019328.

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Budget estimates are included for the following sections: yeast recovery and recycle, alcohol recovery and dehydration, product storage and handling, and general facilities.

56504 **(DOE/RA/50323—1-Vol.9) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume IX. Environmental-impact study.** (Hilo Coast Processing Co., Pepeekeo, HI (USA); Webb (Richard T.), Hilo, HI (USA)). May 1981. Contract FG07-80RA50323. 175p. NTIS, PC A08/MF A01. Order Number DE82019327.

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The environmental impact study covers the following: description of proposed plant, project environment, land use controls, probable impacts, unavoidable adverse impacts, possible alternatives, irreversible commitments, mitigation measures, and estimated project costs. Included in appendices are: stillage disposal, material balance, permit requirements and applicable statutes, Hawaii County Energy Policy, Hawaii County Grading Ordinance, floristic and avian assessments, waste water disposal permit, soils report summary, hydrologists report, and maps of industrial area, wastewater lines, and land containment system.

56505 **(DOE/RA/50323—1-Vol.10) Feasibility study for Hilo Coast Processing Company, Pepeekeo, Hawaii: 11.4-million gallon-per-year motor-fuel-grade ethanol plant. Volume X. Economic analysis.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). May 1981. Contract FG07-80RA50323. 296p. NTIS (US Sales Only). Order Number DE82018808.

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An economic evaluation is presented for the proposed plant for producing 11,414,000 gallons per year of fuel-grade alcohol from 150,000 tons of molasses. The project is economically attractive at a 1981 ethanol sales price of $2.00 per gallon, a 1981 molasses price of $85.00 per ton, and a plant capital investment of $27.45 MM. The evaluation description includes: investment, operating costs, revenues, and economic analysis. Included in appendices are detailed computer printouts for the following scenarios: the constant dollar, the uniform escalation, and the current dollar.

56506 **(DOE/RA/50329—1) Total energy food plant 21 million gallon ethanol facility. Final report.** (Agri-Answer, Inc., Lynn, IN (USA); Battelle Columbus Labs., OH (USA); Clark Dietz Engineers, Inc., Richmond, IN (USA)). Oct 1981. Contract FG07-80RA50329. 571p. NTIS, PC A24/MF A01. Order Number DE82019258.

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The Phase I Engineering study includes the following: process description, waste water treatment plant, material summary, energy chart, capital cost estimate, equipment list, personnel requirements, drawings list, specifications list, and project schedule. The economic and financial feasibility of the technical process, and environmental, health, safety, and socio-economic assessments for the project are reported. The costs for extending the following utilities to the property line of the selected site are presented: potable water, sewer system, electricity, roads for truck traffic, and rail service.

56507 (EUR—7550-EN) **Assessment of how the forest production which is currently not used would be obtained for energy purposes and from this an evaluation of the management methods most appropriate to the production of wood for energy purposes.** King, G.H. (Commission of the European Communities, Brussels (Belgium)). 1981. 153p. Commission of the European Communities, Brussels, Belgium.

For existing plantings and management, the availability of residues and energy in the forest and from the wood processing industry has been shown to be 885 kt/y for 1977 and 2520 kt/y for 2000. Biomass available in 2000 from thinning of existing forests is likely to range from 600 kt/y up to much higher levels if the markets for small roundwood remain weak. Energy plantations of two types have been examined in detail, coppice for the better conditions, single stem growth for the more difficult sites. Suitable species have been evaluated, and areas of land which are at present only partially utilised for food production have been identified. Depending on the conditions, yields are likely to vary from 5-20 t/ha/y giving a potential yield of forest biomass of 16 M dry t/y from 1.5 M ha.

56508 (EUR—7554-EN) **Genetic control of photosynthetic efficiency and hydrogen production in algae.** Henningsen, K.W.; Stummann, B.M.; Bishop, N.I.; Kaufmann, U. (Commission of the European Communities, Brussels (Belgium)). 1981. 30p. Commission of the European Communities, Brussels, Belgium.

This project is undertaken to study the role of nuclear and extranuclear genes controlling functions essential for the hydrogen metabolism of algal cells. The species Clamydomonas reinhardii, Scenedesmus obliquus, Chlorococcum vacuolatum and Golenkinia minutissima were selected for further experimentation. The development of capacity for photohydrogen evolution in relation to pigment accumulation and development of photosynthetic capacity was studied during light dependent development of dark grown cells of greening mutants of Chlamydomonas and Scenedesmus. The two mechanisms of photohydrogen production seem to develop simultaneously. The effects of antibiotics on the development of photochemical activities were investigated.

56509 (EUR—7589-EN) **Biophotolysis of water for H_2 production via natural and artificial catalytic systems.** (Commission of the European Communities, Brussels (Belgium)). 1982. 71p. Commission of the European Communities, Brussels, Belgium.

The characteristics of a biocatalytic system (containing chloroplast membranes, ferrodoxin and hydrogenase) which can produce H_2 from water using solar energy were studied. An in vitro system of chloroplasts (Chenopodium), ferrodoxin, (Spirulina) and hydrogenase (Clostridium) (with oxygen scavengers) liberated H_2 gas continuously for four to six hours, at the rate of 50 μmoles H_2 per h per mg chlorophyll when illuminated with light at 11000 lux at 25°C. The rate and longevity of the reaction depended upon the light- and oxygen-stability of the chloroplasts and hydrogenases and the recycling efficiency of the electron mediator. A number of techniques were tried to immobilize chloroplast membranes and thus improve their stability in light.

56510 (EUR—7594-EN) **Energy recovery by gasification of agricultural and forestry wastes in a co-current moving bed reactor.** (Commission of the European Communities, Brussels (Belgium)). 1981. 122p. Commission of the European Communities, Brussels, Belgium.

Pilot plants with capacities of 4, 13 and 50 kg/h of biomass have been erected to obtain design rules and mass and energy balances for various biomass fuels. A complete physical model has been made of the process. The important process steps have been verified both seperately and intergrated in pilot plant reactors. This was done to improve the reliability of the model, but also to identify the critical steps in the process that determines the proper functioning, gas composition and maximum capacity. The critical process steps have been identified, design rules derived and a solution for scaling up has been found. A wide range of different feedstocks has been gasified in the pilot plant gasifiers (up to 50 kg/h) and a preliminary design for a large scale unit has been made.

56511 (KVL-JI-MEDD—39) **Energy of agricultural crops. Possibilities, present knowledge and proposals of future research.** Have, H. Jun 1981. 102p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82750471.

Possibilities to produce energy of special agricultural crops cultivated before or after traditional crops are investigated. For these catch crops there are about 1.5 mln ha and at the present stage there can be produced about 0.4 mln ton oil equivalents per year. By better cultivation and conversion technology the production can easily grow 5-folds. The most convenient methods are biological gasification, ensiling and combined drying-combustion. All these methods require development in order to use green plants. Costs of energy production of catch crops by the known technology, siloe-conservation and biogas conversion are roughly evaluated to 195-340 Kr/GJ. Improved cultivation and conversion methods are expected to decrease the costs to those of heating fuel oils, i.e. about 108 Dkr/GJ, if compared to 11 oil price of about 3 Dkr. Research programs are proposed, especially in the field of automotive fuels of catch crops. Ethanol and plant oil production has to become first profitable, which is not the case with the present price-system.

56512 (LBL—14725) **Enzymatic hydrolysis of rice straw for ethanol production.** Wald, S.A.; Wilke, C.R.; Blanch, H.W. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract AC03-76SF00098. 184p. NTIS, PC A09/MF A01. Order Number DE82020292.

Thesis. Submitted by Stephen Alan Wald.

This study is concerned with an agricultural residue, rice straw, and its potential as a feedstock for ethanol production. Disposal of the rice straw is required to control the fungal infection called stem rot. The objective of this research was aimed at demonstrating the technical feasibility of ethanol production from rice straw and providing an economic evaluation of a proposed processing scheme. Enzymatic hydrolysis experiments indicated that up to 60% of the available cellulose can be converted to a fermentable sugar solution. A kinetic model was developed to aid in understanding the hydrolysis process and for use in process optimization studies. The model incorporates an enzyme adsorption mechanism, product inhibition, and considers a multiple enzyme and substrate system. Economic evaluation of the proposed processing scheme shows that ethanol can be produced for $2.56 per gallon with an additional raw material cost of $1.43 per gallon. This was based on nominal capacity of 10 million gallons of 95% ethanol annually and a rice straw cost of $30 per dry ton. It is recommended that future research should focus on improving pretreatment and enzyme production techniques. In addition, more emphasis should be placed on effective utilization of all the components of the lignocellulosic material.

56513 (MASEC-CF—81-096, pp 177-205) **Photovoltaic overview.** Bourke, R.D. (Jet Propulsion Lab., Pasadena, CA). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

The way in which solar cells (silicon single crystal) are set up and how they work is explained, at 10% efficiency a square meter would produce about 100 watts. Differing arrangements are possible (Fresnel lens for focusing). Mountings of solar cells on rooftops are discussed and needed power (3 to 10 kW) is possible. A block diagram illustrates installation and instrumentation required. At present, several experimental homes equipped with solar cells have been built. Simulation calculations are described which predict when the solar cell equipped house would need additional power from utilities and when excess power would be available to sell to the utility (through PURPA). Effects on peak demands are considered. The status of the solar cell industry is reviewed with emphasis on costs and modern technology. Projections of price moves of solar cells are carried out and possible problems are considered. (MJJ)

56514 (MASEC-CF—81-096, pp 206-220) **Biomass in the North Central United States.** Morey, V. (Univ. of Minnesota, St. Paul). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Biomass is defined (wood, wood residues, crops, crop residues, and animal manures) and its role as a renewable energy source capable of affecting the electric power industry is discussed. Wood is cited as the only biomass source currently producing significant energy (1.4 to 1.7 quads of a total 80 quads in 1979). By 1985, 5 to 9 quads could be produced from biomass sources and 6 to 17 quads by the year 2000. The location of biomass resources are illustrated and discussed. Possible conversion processes for biomass materials are reviewed with emphasis on wood and wood residues. Wood as an industrial fuel, for home heating use, as a fuel in pellet form, etc., is discussed. The use of residue materials on farms as well as off-farm uses are described briefly. Anaerobic digestion of animal manures to produce methane and production of liquid fuels (methanol) is mentioned. It is concluded that the potential for biomass energy is large but the rate of adoption is uncertain. 2 references. (MJJ)

56515 **(PB—82-159070) The socio-economic context of fuelwood use in small rural communities. Evaluation special study No. 1.** Wood, D.H.; Brokensha, D.; Castro, A.P.; Gamser, M.S.; Jackson, B.A. (Devres, Inc., Washington, DC (USA)). Aug 1980. 323p. NTIS, PC A14/MF A01.

All successful community fuelwood programs must take into account the importance of local participation, consider the specific socioeconomic characteristics of the proposed location and its environs, and critically examine alternative plans and approaches. These are some of the major conclusions of this indepth report which examines the socioeconomic and environmental aspects of fuelwood use in developing countries and analyzes critical issues regarding this use.

56516 **(PB—82-178690) DLTS analysis of residual damage in low-dose ion-implanted silicon. Final report.** Johnson, N.M. (Xerox Palo Alto Research Center, CA (USA)). Feb 1982. 25p. NTIS, PC A02/MF A01.

Transient capacitance spectroscopy was used to measure the energy levels and spatial distributions of residual damage in low-dose ion-implanted silicon. The results indicate that a 800C 30-min anneal in flowing nitrogen successfully reduces arsenic ion-implantation damage to levels not expected to significantly influence C-V measurements of dopant profiles.

56517 **(PNL—3970) Survey of spectral response measurements for photovoltaic devices.** Hartman, J.S.; Lind, M.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1981. Contract AC06-76RL01830. 37p. NTIS, PC A03/MF A01. Order Number DE82006221.

A survey of the photovoltaic community was conducted to ascertain the present state-of-the-art for PV spectral response measurements. Specific topics explored included measurement system designs, good and bad features of the systems, and problems encountered in the evaluation of specific cell structures and materials. The survey showed that most spectral response data are used in diagnostic analysis for the optimization of developmental solar cells. Measurement systems commonly utilize a chopped narrowband source in conjunction with a constant bias illumination which simulates the ambient end use environment. Researchers emphasized the importance of bias illumination for all types of cells in order to minimize the effects of nonlinearities in cell response. Not surprisingly single crystal silicon cells present the fewest measurement problems to the researcher and have been studied more thoroughly than any other type of solar cell. But, the accurate characterization of silicon cells is still difficult and laboratory intercomparison studies have yielded data scatter ranging from +-5% to +-15%. The measurement experience with other types of cells is less extensive. The development of reliable data bases for some solar cells is complicated by problems of cell nonuniformity, environmental instability, nonlinearity, etc. Cascade cells present new problems associated with their structue (multiple cells in series) which are just beginning to be understood. In addition, the importance of many measurement parameters (spectral content of bias light, bias light intensity, bias voltage, chopping frequency, etc.) are not fully understood for most types of solar cells.

56518 **(SAND—81-1406) Test results of early photovoltaic concentrating collectors.** Gerwin, H.J.; Pritchard, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1981. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01. Order Number DE82005867.

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Several passively and actively cooled photovoltaic concentrating collectors built during the period 1976 to 1979 have been tested. The tests provide information on the performance characteristics of these collectors. The results of the tests are summarized.

56519 **(SAND—81-7007) Design and development of a high-concentration photovoltaic concentrator.** Hodge, R.C. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Apr 1982. Contract AC04-76DP00789. 112p. NTIS, PC A06/MF A01. Order Number DE82015673.

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The design and development of a high concentration photovoltaic concentrator module is discussed. The design concept described herein incorporates a curved groove domed Fresnel lens, a high concentration etched multiple vertical junction (EMVJ) solar cell and a passively cooled direct-bonded copper cell mount all packaged in a plastic module. Two seven inch diameter 1200x domed Fresnel lenses were fabricated using single point diamond turning technology. Testing at both GE and Sandia confirmed optical transmission efficiencies of over 83%. Samples of the latest available EMVJ cells were mounted and installed, with a domed Fresnel lens, into a prototype module. Subsequent testing demonstrated net lens-cell efficiencies of 10 to 13%. As a result of this program, salient conclusions have been formulated as to this technology.

56520 **(SAND—81-7009) 2.2-kilowatt photovoltaic concentrator array.** (Sandia National Labs., Albuquerque, NM (USA); Martin Marietta Aerospace Corp., Denver, CO (USA)). Jan 1982. Contract AC04-76DP00789. 100p. NTIS, PC A05/MF A01. Order Number DE82012062.

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Martin Marietta's design, fabrication and installation of an active cooling system for their 2.2 kW pedestal mounted Fresnel lens photovoltaic array is described. The previous design used a finned extruded aluminum passive heat exchanger to keep the solar cells cool. The actively cooled rectangular extruded aluminum channel through which coolant flows and cools the cells. The channel is attached at its center to the tracking structure and it supports two 1 ft. by 4 ft. modules (as with the passive design). The channels for side-by-side module pairs are connected by cast headers and flexible hoses. Coolant flows from module pair to module pair in a serpentine path through the array.

56521 **(SAND—82-0701) Results of testing a development module of the second-generation E-Systems concentrating photovoltaic-thermal module.** Harrison, T.D. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1982. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01. Order Number DE82015671.

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An actively-cooled linear Fresnel lens concentrating photovoltaic and thermal module, designed and built by E-Systems, was tested in the Photovoltaic Advanced Systems Test Facility. Physical, electrical, and thermal characteristics of the module are presented. Module performance is characterized through the use of multiple linear regression techniques.

56522 (SAND—82-7105) **Efficiency-improvement study for GaAs solar cells. Final report, March 31, 1980-September 30, 1981.** Cape, J.A.; Oliver, J.R.; Zehr, S.W. (Sandia National Labs., Albuquerque, NM (USA); Rockwell International Corp., Thousand Oaks, CA (USA)). Apr 1982. Contract AC04-76DP00789. 178p. NTIS, PC A09/MF A01. Order Number DE82016410.

High-yield fabrication of good quality AlGaAs/GaAs concentration solar cells has been a limiting factor in widespread utilization of these high conversion efficiency (22 to 24%) photovoltaic cells. Reported is a series of investigations to correlate solar cell yield with substrate quality, growth techniques, layer composition, and metallization processes. In addition, several diagnostic techniques are described to aid in device characterization.

56523 (SAND—82-7122) **Annual report on high-intensity solar cells.** Schwartz, R.J.; Lundstrom, M.S.; Gray, J.L. (Sandia National Labs., Albuquerque, NM (USA); Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering). Jul 1982. Contract AC04-76DP00789. 93p. NTIS, PC A05/MF A01. Order Number DE82020420.

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Described is a program to support the Sandia National Laboratories effort to develop high-efficiency, high-concentration solar cells. During the past year this support has taken the following forms: providing general analytic support for the development of high-efficiency IBC solar cells, and developing a two-dimensional computer code suitable for modelling the performance of the IBC solar cell and other high concentration cells currently under development.

56524 (SERI/TR—9010-3-T1) **Investigation of mechanically hard, chemically inert antireflection coatings for photovoltaic solar modules. Final technical report, April 1, 1980-March 31, 1981.** Moravec, T.J. (Solar Energy Research Inst., Golden, CO (USA); Honeywell Corporate Technology Center, Bloomington, MN (USA)). 31 Mar 1981. Contract AC02-77CH00178. 27p. D. Order Number DE82007267.

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The overall objective of this program is to determine the optical properties of i-Carbon (diamond-like) films and determine if these films can be developed into antireflecting (AR) coatings for silicon solar cells. The i-C films have been produced on glass, silicon, and KCl by radio frequency (RF) plasma decomposition of the alkane gases. Films were also produced on silicon solar cells by low-energy ion beam techniques. These coatings did not perform as well as those made from hydrocarbon gases. Significant progress has been made in understanding the deposition parameters that affect the optical properties of the films. The optical constants n and k have been determined over a large range of process parameters and source gas. The degree of hydrogen incorporation in these films has been studied by SIMS analysis. It was found that the lower optically absorbing films contain more hydrogen. This hydrogen does not, however, manifest itself in fundamental C-H absorption bands in the infrared. Very efficient single-layer quarter-wave i-C AR coatings have been produced on single-crystal and SOC Si solar cells. An increase in cell efficiency of 40% over uncoated cells has been achieved.

56525 (SERI/TR—9079-1-T7) **Structure and electronic studies of defects in amorphous silicon. Final report, May 1981-April 1982.** Street, R.A. (Solar Energy Research Inst., Golden, CO (USA); Xerox Palo Alto Research Center, CA (USA)). Jul 1982. Contract AC02-77CH00178. 30p. NTIS, PC A03/MF A01. Order Number DE82018228.

The properties of glow discharge deposited amorphous silicon were studied. The study concentrated on two aspects of the structural properties of a-Si:H and the role of the defects and localized states on the transport and recombination. One structure aspect concerns the reactions that take place at a metal/a-Si:H interface. The other is the use of NMR to study the hydrogen bonding, particularly the spin-lattice relaxation times. The details of recombination are studied by luminescence and light-induced ESR. Optically detected magnetic resonance and time-resolved ESR were also used. High temperature recombination and trapping were studied by using the time-of-flight transient photoconductivity method, obtaining the trapping parameters for capture of both electrons and holes at dangling bonds. A limited number of p-i-n solar cells were made and their properties and collection efficiency investigated. Using the technique of photothermal deflection spectroscopy, which measures weak optical absorption, the extrinsic absorption from dangling bonds has been identified and correlated with other measurements. (LEW)

56526 (SERI/TR—19451-1) **Industrial biomass market assessment: a subcontract report.** Huff, W.J.; Kennel, R.P.; Schertz-Willett, L.; Steadman, P.E.; Krawiec, F. (Solar Energy Research Inst., Golden, CO (USA); Ultrasystems, Inc., Fairfax, VA (USA)). Jul 1982. Contract AC02-77CH00178. 323p. NTIS, PC A14/MF A01. Order Number DE82019264.

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Industries outside the forest products industry that are most able to replace conventional fuels with wood fuel are identified and characterized. The study approach selects industrial wood fuel conversion candidates from industrial plants nationwide. The research effort involved (1) develops a series of selection criteria to identify plants having a high potential for wood fuel use; (2) selects wood fuel conversion candidates by taking into account data on industry, combustion systems, geography, and wood fuel and using a rational decision matrix; and (3) prepares a final validated list of plant sites. The 6466 plants were ranked using subjective criteria and weighting into 616 first-priority, 1860 second-priority candidates, and 3990 third-priority candidates.

56527 (TVA/OACD—82/9) **Biomass fuels update. TVA's biomass fuels program.** (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). Feb 1982. 28p. NTIS, PC A03/MF A01. Order Number DE82904990.

Seven projects were active. Equipment was installed and initial research tests were conducted on the ethanol-from-hardwood project - the main project in the program. Activities were conducted to assess location of hardwoods, to improve forest management, and to reduce the cost of harvesting woody biomass. Direct combustion of wood to replace oil and natural gas is feasible technology in many instances, yet very few commercial systems have been installed; hence technical assistance was provided to potential users. Substantial underutilized cropland exists in the Valley, and a questionnaire survey was administered to supplement cropland data available from the Agricultural Census and Conservation Needs Inventory. Experiments were conducted to determine the potential liquid fuel yields and production management practices for alternative starch, sugar, and vegetable oil crops. A 10-gallon-per-hour prototype fuel alcohol test unit, partially funded by the Department of Energy (DOE), was designed, constructed, and operated to obtain benchmark data and to evaluate alcohol production from alternative agricultural feedstocks. Workshops were conducted to provide information on production of alcohol. In cooperation with DOE, portions of the TVA fleet were involved in a gasohol test program.

56528 **Efficient cadmium sulphide on silicon solar cells.** Arya, R.R.; Sarro, P.M.; Loferski, J.J. (Division of Engineering, Brown University, Providence, Rhode Island 02912). *Applied Physics Letters;* **41**: No. 4, 355-357(15 Aug 1982).

p-Si/CdS heterojunction solar cells, fabricated by single source evaporation of CdS over silicon at low temperatures (~175 °C), which have solar power conversion efficiencies up to 11%, measured under simulated AM1 illumination, are described.

56529 **Combined microcrystal and amorphous silicon cells.** Fang, P.H.; Schubert, C.C.; Bei, P.; Kinnier, J.H. (Boston College, Chestnut Hill, Massachusetts 02167). *Applied Physics Letters;* **41**: No. 4, 365-366(15 Aug 1982).

Solar cells have been constructed by depositing a microcrystalline p-silicon layer on an amorphous i-n structure. Here p and n denote the type of dopant and i the intrinsic. The silicon layers are formed by electron beam evaporation and doped through the coevaporation of boron for p type and antimony for n type. After hydrogenation by plasma annealing, solar cells are obtained with an open circuit voltage of 540 mV and short circuit current of 5 mA/cm^2 under AMl simulated light. The fill factor is 46%.

56530 Photoelectrochemical oxidation of aromatic hydrocarbons and decamethyl ferrocene at the n-GaAs/room temperature molten salt electrolyte interface. Thapar, R.; Rajeshwar, K. (Colo State Univ, Fort Collins). *Journal of the Electrochemical Society;* **129**: No. 3, 560-565(Mar 1982).

Photoelectrochemical (PEC) oxidation of decamethyl ferrocene ((/eta//sup 5/-(CH/sub 3/)/sub 5/C/sub 5/)/sub 2/Fe), benzo (a) pyrene (BP), 9, 10-diphenylanthracene (DPA), anthracene (A), and hexamethyl benzene (HMB) on n-GaAs electrodes in contact with the aluminum chloride-n-butyl pyridinium chloride (AlCl/sub 3/-BPC) molten salt electrolyte, was studied by cyclic and linear sweep voltammetry. In the case of DPA and A, evidence from cyclic voltammetry indicated photooxidation to the dication, probably caused by injection of an electron from the cation radical into the conduction band in n-GaAs. The location of the reduction waves on n-GaAs in the cyclic voltammograms for BP, DPA, and A further indicated a second set of surface states situated very close to the valence bandedge. Linear sweep voltammograms on n-GaAs in the dark and under illumination showed the usual rectification behavior associated with n-type semiconductor/electrolye junctions. 16 refs.

56531 Semiconductor electrodes - 44. photoelectrochemistry at polycrystalline p-type WSe_2 films. Abruna, H.D.; Bard, A.J. (Univ of Tex, Austin). *Journal of the Electrochemical Society;* **129**: No. 3, 673-676(Mar 1982).

Photoelectrochemical (PEC) cells based on layered semiconductors are particularly attractive for solar energy conversion for a number of reasons. The preparation of polycrystalline p-WSe/sub 2/ electrodes which show better than 1% red light efficiencies in photovoltaic (regenerative) PEC cells is described. The PEC behavior of these electrodes was investigated in cells containing a number of redox couples. It is difficult to account for the success of these polycrystalline films as photoelectrodes compared to earlier preparations. The method of surface pretreatment of the substrate appears to be important. 27 refs.

56532 Cathodic deposition of amorphous silicon from solutions of silicic acid and tetraethyl orthosilicate in ethylene glycol and formamide containing HF. Rama Mohan, T.R.; Kroger, F.A. (Univ of South Calif, Los Angeles, USA). *Electrochimica Acta;* **27**: No. 3, 371-377(Mar 1982).

Amorphous silicon containing carbon, hydrogen and fluorine were electrodeposited from solutions containing ethylene glycol, hydrofluoric acid, and tetraethyl orthosilicate or silicic acid. The deposits were characterized by electrical resistance and IR reflectance measurements. The deposits exhibited point contact electrical resistances from 10/sup 4/ to 10/sup 14/ ohm cm/sup -1/ which could be changed by making suitable changes in the composition of the electrolyte or the conditions of electrolysis. The conductivity of the deposits was changed from p- to n-type by doping with phosphorus achieved by adding triethyl phosphate to the electrolyte. 38 refs.

56533 Photoelectrolysis at Fe_2O_3/TiO_2 heterojunction electrode. Liou, F.T.; Yang, C.Y.; Levine, S.N. (Brookhaven Natl Lab, Upton, NY). *Journal of the Electrochemical Society;* **129**: No. 2, 342-345(Feb 1982).

An attempt is made to combine the best features of two materials by forming a heterojunction consisting of a thin film of polycrystalline n-type TiO/sub 2/ deposited on n-type polycrystalline Fe/sub 2/O/sub 3/. Evidence is presented that, under illumination, holes generated in the Fe/sub 2/O/sub 3/ participate in the water decomposition reaction. That is, incident light (2.2<h/sub //nu/ <3.0 ev) passes through the TiO/sub 2/ and generates holes (and associated electrons) in the underlying Fe/sub 2/O/sub 3/ which then, under appropriate bias, contribute to the electrode reaction at the TiO/sub 2//electrolyte interface. 13 refs.

56534 Silicon solar cells with reduced temperature sensitivity. Green, M.A.; Emery, K.; Blakers, A.W. (Sol Energy Res Inst, Golden, Colo, USA). *Electronics Letters;* **18**: No. 2, 97-98(21 Jan 1982).

As the open-circuit voltage of silicon solar cells continues to improve, one resulting advantage, not widely appreciated, is reduced temperature sensitivity of device performance. Recently a new type of silicon solar cell has been described which has resulted in a significant increase in open circuit voltage. Experimental results are descirbed for these devices which demonstrate low temperature sensitivity for silicon cells under unconcentrated sunlight. With further improvements in voltage, it should be possible to approach the relative temperature insensitivity of some high performance GaAs devices. 6 refs.

56535 (PB—82-154493) Utilization and processing of forest energy. Part 3. Equipment techniques of biomass pelletization. Kytoe, M.; Aeijaelae, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Poltto- ja Voiteluainelab.). 1982. Translation of Metsaeenergian Kaeytto ja Jalostus, Espoo, March 1981. 52p. NTIS, PC A04/MF A01.

Drying and densification of biomass to homogeneous pellets or briquettes improves its calorific value and reduces storage and handling costs. Techniques used for pelletizing wood and peat are largely based on that of fodder pelletization. There is industrial experience from the pelletization of waste wood and bark primarily in the USA and Canada. Experience from briquetting wood and peat has also been attained in Finland. This literature study surveys experiences and research results concerning densification techniques. In addition to ram presses and screw extruders, roll presses are also used for briquetting. In these the raw material is compressed to briquettes between two patterned rotating roll rings. The capacity of the biggest roll presses is as high as 50 t/h for briquetting brown coal. As far as is known there is no experience from wood briquetting.

56536 Utilization of carbohydrates by thermomonospora sp. grown on glucose, cellobiose, and cellulose. Moreira, A.R.; Phillips, J.A.; Humphrey, A.E. (Univ. of Pennsylvania, Philadelphia). *Biotechnology and Bioengineering;* **23**: No. 6, 1325-1338(Jun 1981).

Thermomonospora sp. was grown on glucose, cellobiose, and cellulose in order to study its growth characteristics with different carbohydrate substrates. It was observed that the nitrogen and protein contents of the cells are essentially constant during the fermentation and independent of the carbon source when glucose or cellobiose are utilized. Under oxygen starvation conditions it was shown that unidentifiable organic compound(s) accumulate(s) in the culture broth. Culture fluorescence was shown to be an excellent variable for monitoring and control of the fermentation process. This microorganism showed a preference for crystalline cellulose (Avicel) as substrate although it grows readily on a more amorphous cellulose (Solka Floc). The production of extracellular protein is shown to be growth related. Data were obtained confirming the decrease in the number of active adsorption sites as the cause for the decrease in the cellulose digestion rate. 17 refs.

56537 Inorganic carbon sources and biomass regulation in intensive microalgal cultures. Goldman, J.C.; Dennett, M.R.; Riley, C.B. (Woods Hole Oceanogr Inst., MA). *Biotechnology and Bioengineering;* **23**: No. 5, 995-1014(May 1981).

Three freshwater and one marine algal species were grown under inorganic carbon limitation in laboratory continuous cultures. Comparisons were made between HCO/sub 3//sup -/ alkalinity and bubbled CO/sub 2/ as carbon sources. HCO/sub 3//sup -/ alkalinity was an excellent source of inorganic carbon below specific pH levels, but chemical precipitation at high pH placed an upper limit on productivity that was far lower than potential light-limiting levels. With bubbled CO/sub 2/ it was possible to achieve light limitation. At 1% CO/sub 2/ productivity was still dependent on mass fluxes of added carbon, but was independent of bubble size. At high bubble rates with 1% CO/sub 2/ narcosis was evident. Maximum yields occurred at intermediate dilution rates when inorganic carbon was supplied via bubbled gas. 35 refs.

56538 **Geothermal heat utilization in a wood-fired electric power plant.** Johnson, K.R. (GeoProducts Corp., Oakland, CA). *Geothermal Resources Council, Special Report;* No. 10, 35-38(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

Throughout the Western United States there are a significant number of sites with low to moderate temperature geothermal resources. In many areas coincident with this geothermal resource are some of the nation's prime timberlands. In the production of electric power considerable operating savings can result with a combination of these two resources compared to a conventional wood fired facility. An ongoing attempt to develop and utilize this resource combination is examined.

56539 **Experimental study of SO_3 dissociation as a mechanism for converting and transporting solar energy.** McCrary, J.H.; McCrary, G.E.; Chubb, T.A.; Won, Y.S. (NM State Univ, Las Cruces, USA). *Solar Energy;* **27**: No. 5, 433-440(1981).

A facility for evaluating chemical converter-heat exchangers at temperatures to 1000/degree/C with high flow rates of gaseous SO/sub 3/ feedstock has been assembled and operated. Several quartz and metal reactors containing different catalyst configurations have been tested. Descriptions of the test facility and of the reactors are given along with a presentation and discussion of experimental results. 6 refs.

56540 **Growth of silicon sheets for photovoltaic applications.** Surek, T. (Sol Energy Res Inst, Golden, Colo, USA). *Proceedings - Electrochemical Society;* **80-5**: 173-183(1980). (CONF-800544—).

From Electrochemical Society meeting; St Louis, MO, USA (11 May 1980).

The status of silicon sheet development for photovoltaic applications is critically reviewed. Silicon sheet growth processes are classified according to their linear growth rates. The "fast" growth processes, which include edge-defined film-fed growth, silicon-on-ceramic, dendritic-web growth and ribbon-to-ribbon growth, are comparatively ranked subject to criteria involving growth stability, sheet productivity, impurity effects, crystallinity and solar cell results. The status of more rapid silicon ribbon growth techniques, such as horizontal ribbon growth and melt quenching, is also reviewed. The emphasis of the discussions is on examining the viability of these sheet materials as solar cell substrates for low-cost silicon photovoltaic systems. 4 refs.

56541 **DOE Photovoltaics Program.** Ferber, R.R. (JPL, Pasadena, CA). *NASA Conference Publication;* No. 2149, 133-143(1980). (CONF-8005218—).

From NASA conference on technology for business and industry; Cleveland, OH, USA (14 May 1980).

Technology development objectives to develop technically feasible, low-cost photovoltaic component and subsystem technologies to the point where technology readiness can be demonstrated are reported. Flat-plate solar arrays, concentrator collector technology development objectives, system performance requirements, present and future applications are presented and discussed.

56542 **Field testing and evaluation of PV module performance.** Forman, S.E. (Massachusetts Inst. of Tech., Lexington). pp 41-46 of 13th Photovoltaic specialists conference: conference record. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

Between March of 1977 and June of 1978, MIT Lincoln Laboratory in conjunction with the Department of Energy, placed 41.5 kilowatts of photovoltaic modules at various experimental test sites in the United States. The largest of these include a 25 kilowatt array in Mead, Nebraska, which is used for corn irrigation and crop drying and a 15 kilowatt rooftop test bed in Lexington, Massachusetts, which is used to evaluate components of photovoltaic systems prior to field installation. This report summarizes the performance of the photovoltaic modules and describes the physical and electrical changes which have occurred due to weathering and soil accumulation during that time period. To date only nine modules amounting to 130 watts have experienced electrical failures.

56543 **Multiple silicon ribbon growth by EFG.** Mackintosh, B.H.; Surek, T.; Kalejs, J.P.; Sachs, E.M.; Nagy, S.; Wald, F.V. (Mobil Tyco Solar Energy Corp., Waltham, MA). pp 350-357 of 13th Photovoltaic specialists conference: conference record. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

The background and progress to date of EFG ribbon growth for solar cell applications are briefly reviewed. The design and operation of a multiple ribbon-per-operator manufacturing system are then described. Results are presented of cost studies of this system at three stages of development. In the latter stage, believed to be attainable by 1986, conversion costs for polycrystalline silicon into wafers are attained which are consistent with manufacture of photovoltaic systems at $0.50 per peak watt. Principal technological problems in the ribbon growth process are discussed.

56544 **Motor starting with PV systems.** Landsman, E.E. (MIT, Lexington, Mass.). pp 992-995 of 13th photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

An inverter designed to start induction motors on photovoltaic power systems without storage is described. The variable voltage/frequency starting, with the motor started at low frequency and a correspondingly scaled voltage, and then slowly increasing voltage and frequency to the nominal running values provides an answer to induction motors starting problems. This method allows starting the motor with stall torques comparable to those obtained from across-the-line starting, but with virtually no input power transient. The experimental units have operated in excess of 1500 hours without failures or load damage, and it is concluded that the variable voltage/frequency operation coupled with fast acting inverter protective circuitry has been proven in field use.

56545 **Status of the DOE Photovoltaic Concentrator Technology Development Project.** Edenburn, M.W.; Schueler, D.G.; Boes, E.C. (Sandia Laboratories, Albuquerque, N. Mex.). pp 1028-1039 of 13th photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

A report on the progress of the DOE Photovoltaic Concentrator Technology Development Project, which has undertaken the development of low-cost photovoltaic devices, is presented. Test results obtained in three areas of interest, solar concentrators, concentrator array subsystems, and concentrator cell technology, are summarized, and five-year cost and efficiency targets for each of these areas are given. The performance and design characteristics of a variety of photovoltaic concentrators are presented. Cost data and specular reflectance properties of a wide range of mirror materials, including second-surface glass, metallized plastic films and polished, bulk aluminum, are reported, together with hail-test results and typical focal lengths of slope errors for model parabolas.

56546 **Design, technology and cost of Si cells for concentrator applications.** Dalal, V. (Delaware, University, Newark, Del.). pp 1040-1045 of 13th photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

The design of large area (more than 10 sq cm), high efficiency, low-cost Si solar cells for use under low to medium concentration (10-100 x) is discussed. Constraints imposed on the junction and grid technology, base layer characteristics, and anti-reflection surface for high-efficiency operation at these concentration levels are examined. Within the context of these constraints, it is concluded that both n and p based are acceptable for operation up to 50 suns n-type bases are preferable beyond these concentrations. Junction formation by ion implantation is preferable to vapor phase diffusion, as diffused layers of low sheet resistance have low quantum efficiencies for short-wavelength photons. Ion implantation gives precise control of impurity profiles with dopant densities well below the solid-solubility limits. The optimum grid design for high intensity cells consists of rectangular grids with cross bus-bars, a structure limiting total Ohmic losses to about 15%. Textured antireflection surfaces are desirable as the effective absorption constant is increased by light trapping.

56547 (DOE/ET/20074—T7) Eucalyptus plantations for energy production in Hawaii. 1980 annual report, January 1980-December 1980. Whitesell, C.D. (BioEnergy Development Corp., Hilo, HI (USA)). [nd]. Contract FC03-78ET20074. 94p. NTIS, PC A05/MF A01. Order Number DE82009495.

In 1980 200 acres of eucalyptus trees were planted for a research and development biomass energy plantation bringing the total area under cultivation to 300 acres. Of this total acreage, 90 acres or 30% was planted in experimental plots. The remaining 70% of the cultivated area was closely monitored to determine the economic cost/benefit ratio of large scale biomass energy production. In the large scale plantings, standard field practices were set up for all phases of production: nursery, clearing, planting, weed control and fertilization. These practices were constantly evaluated for potential improvements in efficiency and reduced cost. Promising experimental treatments were implemented on a large scale to test their effectiveness under field production conditions. In the experimental areas all scheduled data collection in 1980 has been completed and most measurements have been keypunched and analyzed. Soil samples and leaf samples have been analyzed for nutrient concentrations. Crop logging procedures have been set up to monitor tree growth through plant tissue analysis. An intensive computer search on biomass, nursery practices, harvesting equipment and herbicide applications has been completed through the services of the US Forest Service.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 56475, 56476, 56477, 56513, 57050, 57130, 57134, 57147

56548 (AD-A—108889/7) Design of mobile photovoltaic power systems: 0.5-3 kW. Final report. Gibson, R.D. (Solarex Corp., Rockville, MD (USA)). 1 Oct 1981. 133p. NTIS, PC A07/MF A01.

This contract effort can be summarized by four technical tasks: Task 1 - Analysis of Engine-Generator Inventory and Use for a less than 5 kW system; Task 2 - Parametric analysis of the Transportability of Photovoltaic System, i.e., the range of size and weight of transportable trailers and the associated PV generator size; Task 3 - Preliminary Cost Estimates for Photovoltaic Systems; and Task 4 - Preliminary Photovoltaic System Design. The results are presented of Task 1 for the engine generator set planned inventory and characteristics. Task 1 also contained candidate photovoltaic system configurations which would be compared with the engine-generator characteristics identified in Task 1. A parametric study was made of sizing trade-offs between photovoltaic arrays and battery storage capacities which were capable of at least meeting the identified engine-generator characteristics and on structural designs for the photovoltaic array and storage battery for the two trailer configurations. The preliminary cost estimate support in Task 3 involved life cycle cost analysis for the system sizes studied in Task 1. The Task 4 preliminary system design support consisted of examining the results of Tasks 1, 2 and 3 and determining characteristics of transportable photovoltaic systems.

56549 (CONF-820735—2) Analysis of the harmonics and power-factor effects at a utility-intertied photovoltaic system. Campen, G.L. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE82018257.

From IEEE Power Engineering society summer meeting; San Francisco, CA, USA (18 Jul 1982).

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Outlined are the harmonics and power-factor characteristics and effects of a single residential photovoltaic (PV) installation using a line-commutated inverter. The data were taken during a five-day measurement program conducted at the John F. Long House, which is a prototype residential PV installation located in Phoenix, Arizona. The magnitude and phase of various currents and voltages from the fundamental to the 13th harmonic were recorded both with and without the operation of the PV system. A candidate method of modeling the installation for computer studies of larger concentrations is given.

56550 (DOE/ET/20279—197) Data report for the Southwest Residential Experiment Station, March 1982. Lieberman, M.; Durand, F.; Hocking, G.; Whitaker, C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.; New Mexico Solar Energy Inst., Las Cruces (USA)). 26 May 1982. Contract AC02-76ET20279. 25p. NTIS, PC A02/MF A01. Order Number DE82020400.

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Physical performance data obtained from the photovoltaic energy systems under test at the Southwest Residential Experiment Station in New Mexico are tabulated for the month of March 1982. Eight prototype residential photovoltaic systems are under test, each consisting of a roof-mounted photovoltaic array sized to meet at least 50% of the annual electric demand of an energy-conserving house. An enclosed structure houses the remainder of the photovoltaic system equipment, test instrumentation, and work space. Each system is grid-connected. Features of the residential photovoltaic systems and monitored houses are tabulated. A monthly summary is provided of meteorological data, monitored house information, and photovoltaic array, power conditioning unit, and utility interface data. Monthly averages for each hour of an average day are given of total electric energy used by each house, and of array output, inverter output, load, energy supplied to and by utility, maximum power, and total tilt insolation for each prototype system. Hypothetical data are also given of energy supplied to and from the utility at each monitored house for each hour if each prototype photovoltaic system were installed there. Energy histograms are provided for each prototype system. (LEW)

56551 (DOE/ET/20279—201) J.F. Long experimental photovoltaic house. Final report. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.; Long (John F.) Properties, Inc., Phoenix, AZ (USA)). Jun 1982. Contract AC02-76ET20279. 180p. NTIS, PC A09/MF A01. Order Number DE82020506.

A photovoltaic system was installed and monitored for one year at a three-bedroom, two-bath residence located in the suburbs of Phoenix, Arizona. The roof consists of 120 solar modules divided into five sub-arrays. The output is converted to ac and the system is grid-connected. The performance of the system overall, of the photovoltaic arrays, inverter, utility interface, and data acquisition system were measured and discussed. Public acceptance of the system is also discussed. The system is illustrated, and performance data are extensively tabulated and graphed. (LEW)

56552 (DOE/ET/20279—202) Simulation of thermal aspects of residential photovoltaic systems. Hart, G.W.; Raghuraman, P. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Jun 1982. Contract AC02-76ET20279. 37p. NTIS, PC A03/MF A01. Order Number DE82020399.

A TRNSYS program has been developed to simulate the performance of utility-interactive residential photovoltaic (PV) energy systems. The PV system is divided into its major functional components, which are individually described with computer models. These models are described in detail. The results of simulation and actual measured data obtained at MIT Lincoln Laboratory's Northeast Residential Experiment Station are compared. The thermal influences on the design of such PV energy systems are given particular attention.

56553 **(DOE/ET/20279—209) Total Environmental Action, Inc. final report: design and fabrication of a prototype system for photovoltaic residences in the Southwest.** (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.; New Mexico Solar Energy Inst., Las Cruces (USA)). Jun 1982. Contract AC02-76ET20279. 62p. NTIS, PC A04/MF A01. Order Number DE82020783.

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Described are the design of a photovoltaic-powered residence for the American Southwest, dubbed Casa fotovoltaica, and the construction of a prototype building at the Southwest Residential Experiment Station (SWRES) for testing the performance of the full-size photovoltaic (PV) system. Included are architectural drawings of both the residence and the prototype, analysis of the energy requirements of the residence, prediction of PV system output, description of the electrical system, and history of the construction process of the prototype.

56554 **(DOE/ET/20279—211) Hawaii Natural Energy Institute final report on three innovative photovoltaic applications for residences experiments.** Neill, D.R.; Curtis, G.D. (Massachusetts Inst. of Tech., Cambridge (USA); Hawaii Univ., Manoa (USA). Hawaii Natural Energy Inst.). Jun 1982. Contract AC02-76ET20279. 59p. NTIS, PC A04/MF A01. Order Number DE82020786.

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Discussed is a research program to install utility-backed photovoltaic (PV) power systems in three lived-in residences in Hawaii. The goals of the program were to identify and develop solutions to problems related to PV installation, demonstrate system performance in real-world situations, and analyze penetration of PV to the utilities. The PV systems and their installation are described as well as the data collection systems used to monitor performance. The project is evaluated and costs are summarized.

56555 **(DOE/ET/20279—220) Data report for the Northeast Residential Experiment Station, May 1982.** Russell, M.C.; Raghuraman, P.; Mahoney, P.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Jun 1982. Contract AC02-76ET20279. 20p. NTIS, PC A02/MF A01. Order Number DE82020398.

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Tabulated are physical performance data for the month of May 1982 obtained from photovoltaic energy systems under test at the Northeast Residential Experiment Station in Concord, Massachusetts. Five prototype residential photovoltaic systems are presently under test, each consisting of a roof-mounted photovoltaic array sized to meet at least 50% of the annual electrical demand of an energy-conserving house. There is also an enclosed structure to house the remainder of the system equipment, test instrumentation, and work space. All the systems are grid-connected. In addition to these prototype systems and monitored houses, one full-sized photovoltaic residence is being monitored in Carlisle, Massachusetts. The features of the prototype systems and monitored houses are tabulated, and the monthly summary tabulates meteorological information, monitored house information, and data for the photovoltaic array and power conditioning unit and the utility interface. For each hour of an average day of the month and for each house, there is tabulated the total electric energy used, array output, inverter output, inverter power, load imposed on the prototype, energy supplied to and by the utility, solar array panel temperature, and total tilt insolation. Also included is a table and histograms that present the hypothetical energy exchange with the utility if each prototype system supplied energy to each monitored house. The duration of time for which the load of each house had a specific value is graphed. (LEW)

56556 **(PB—82-161514) Electric power from orbit: a critique of a satellite power system.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). Aug 1981. 360p. NTIS, PC A16/MF A01.

This report examines the concept of a satellite power system (SPS) and provides a critique of an evaluation of the concept made by the U.S. Department of Energy (DOE). If it were to be built, an SPS would consist of a number of huge satellites moving in orbit, each over a fixed point on the earth, and collecting solar energy for conversion into a concentrated form for transmission to earth day and night. There, receiving antennas would collect it and convert it into electricity to be fed into the nation's power distribution network.

56557 **(SAND—80-7012) Identifying electrical loads which can use direct photovoltaic dc power.** Goff, H.C.; Chan, T.S.; Allred, R.; Dale, D.W.; Nichols, J.A. (Sandia National Labs., Albuquerque, NM (USA); General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Nov 1981. Contract AC04-76DP00789. 188p. NTIS, PC A09/MF A01. Order Number DE82005716.

Portions of document are illegible.

The major results are presented of a study for identifying electrical loads which can utilize direct current electricity. Also presented are conceptual designs for photovoltaic systems to provide dc power for a reverse osmosis water desalination system, a commercial/industrial fluorescent lighting system, and a telephone circuit switching application.

56558 **(SAND—81-7019/1) Study of photovoltaic residential retrofits. Volume I. Executive summary.** Mahone, D.E.; Temple, P.L.; Adams, J.A.; Chalmers, B.B.; Motter, A.E.; Millner, A.E. (T.E.A., Inc., Harrisville, NH (USA); TriSolar Corp., Bedford, MA (USA)). Apr 1982. Contract AC04-76DP00789. 84p. NTIS, PC A05/MF A01. Order Number DE82015793.

Portions of document are illegible.

The problems and potentials are analyzed for widespread residential retrofits of PV power systems. Included are data on the existing housing stock, designs for array mounting and system electrical wiring, and economic analyses for retrofits.

56559 **(SAND—81-7085/8) Intermediate photovoltaic system application experiment operational performance report. Volume 8 for Lovington Square Shopping Center, Lovington, NM.** (Sandia National Labs., Albuquerque, NM (USA); Boeing Computer Services Co., Seattle, WA (USA)). Feb 1982. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01. Order Number DE82012060.

Portions of document are illegible.

For the month of January, 1982, performance data are given for a grid-connected photovoltaic power supply at a New Mexico shopping center. Data presented include: daily and monthly energy produced; daily and monthly incident solar energy; daily and monthly array efficiency; plots of energy produced as a function of power level, voltage, cell temperature, and hour of the day; power conditioner input, output and efficiency for two individual units and for the total power conditioning system; daily and monthly photovoltaic energy supplied to the load and the corresponding dollar value for the month; photovoltaic system efficiency; capacity factor; daily system availability; daily and hourly insolation; daily and hourly ambient temperature; daily and hourly wind speed; wind direction distribution; heating and cooling degree days; number of freeze/thaw cycles; hourly cell temperature; daily data acquisition mode and recording interval plot. Also included are brief summaries of three operations-related events. (LEW)

56560 **(SAND—81-7085/10) Intermediate photovoltaic system application experiment operational performance report. Volume 10. Lovington Square Shopping Center, Lovington, NM (USA).** (Boeing Computer Services Co., Seattle, WA (USA)). Apr 1982. Contract AC04-76DP00789. 29p. NTIS, PC A03/MF A01. Order Number DE82015792.

Performance data are presented for a photovoltaic power supply at a New Mexico shopping center for the month of March, 1982. Data given include: daily and monthly electrical energy produced; daily and monthly solar energy incident in the array plane; daily and monthly efficiency; energy produced as a function of power level, voltage, cell temperature, and hour of the day; power conditioner input, output, and efficiency for two units and for the overall power conditioning system; daily and monthly photovoltaic energy supplied to the load and the corresponding dollar value; system efficiency; capacity factor; daily availability; daily and hourly insolation, ambient temperature, and wind speed; hourly cell temperature; wind direction distribution; heating and cooling degree days; number of freeze/thaw cycles; and the data acquisition mode and recording interval plot. Also included is a report of operation and maintenance for the month. (LEW)

56561 (SAND—81-7086/10) Intermediate photovoltaic system apploication experiment operational performance report. Volume 10. Newman Power Station, El Paso, TX. (Boeing Computer Services Co., Seattle, WA (USA)). Apr 1982. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01. Order Number DE82015791.

Performance data are presented for a photovoltaic power supply at a Texas utility for the month of March, 1982. Data given include: daily and monthly electrical energy produced; daily and monthly solar energy incident in the array plane; daily and monthly efficiency; energy production as a function of power level, voltage, cell temperature, and hour of the day; daily and monthly photovoltaic power to the load and the corresponding dollar value; capacity factor; daily availability; daily and hourly insolation; daily and hourly ambient temperature; daily and hourly wind speed; wind direction distribution; hourly cell temperature; heating and cooling degree days; number of freeze/thaw cycles; and data acquisition mode and recording interval plot. Also included is an operations and maintenance report summarizing two events. (LEW)

56562 (SAND—81-7088/3) Intermediate photovoltaic system application experiment operational performance report. Volume 3 for Beverly High School, Beverly, MA. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1981. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01. Order Number DE82006236.

Software and hardware problems resulted in the loss of sixteen days of data during September. The total electrical energy produced by the PV system during September is listed as 3986 kWh. The meter is manually read only about every other month, but readings which bracket a majority of the days of the month of September indicate an average daily output of 220 kWh per day or 6600 kWh total for the month. Using the average inverter efficiency of 88 percent, shown in report Module 4, infers that the array produced 7500 kWh of dc output energy during September. Similar analysis for October, when data was collected for 26 of 31 days, infers that total system output for the full 31 days was approximately 6800 kWh rather than the recorded value of 5782 kWh.

56563 (SAND—81-7088/7) Intermediate photovoltaic system application experiment operational performance report. Volume 7. Beverly High School, Beverly, MA. (Boeing Computer Services Co., Seattle, WA (USA)). Apr 1982. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01. Order Number DE82015790.

Portions of document are illegible.

Performance data are given for a grid-connected photovoltaic power supply at a Massachusetts high school for the month of March, 1982. Data presented include: daily and monthly electrical energy produced; daily and monthly solar energy incident in the array plane; daily and monthly array efficiency; energy produced as a function of power level, voltage, cell temperature, and hour of the day; power conditioner input, output, and efficiency for two power conditioner units and for the overall power conditioning system; daily and monthly photovoltaic energy to load and the corresponding dollar value; grid to load energy from February 17 through April 5; photovoltaic system efficiency; capacity factor; daily system availability; daily and hourly insolation; heating and cooling degree days; hourly and monthly ambient temperature; hourly and monthly wind speed; wind direction distribution; number of freeze/thaw cycles; hourly cell temperature; and data acquisition mode and recording interval plot. Also included are seven summaries of site events. (LEW)

56564 (SAND—81-7099/6) Intermediate photovoltaic system application experiment operational performance. Volume 6 for Lovington Square Shopping Center, Lovington, NM. Executive summary. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1982. Contract AC04-76DP00789. 8p. NTIS, PC A02/MF A01. Order Number DE82015476.

Performance data are presented for a 100 kW-peak grid connected flat panel photovoltaic power supply at a New Mexico shopping center for the month of December 1981. Data include daily and monthly electrical energy produced, daily and monthly incident solar energy in the array plane, efficiency of the array and of the power conditioner, capacity factor, insolation, and the data acquisition mode and recording interval plot. Also included is a site event report involving the operating data acquisition system. (LEW)

56565 (SAND—81-7172) Analysis of small commercial photovoltaic applications. Herz, J.; Allred, R.; McCarthy, R. (Sandia National Labs., Albuquerque, NM (USA); General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Jul 1982. Contract AC04-76DP00789. 162p. NTIS, PC A08/MF A01. Order Number DE82020924.

The objective of this study was to determine promising small commercial (to 500 kW) grid connected photovoltaic applications. Twelve applications were evaluated, including detailed performance and economic analyses covering different collector types, utility rate structures and geographic locations. The attractiveness of battery storage was also examined.

56566 (SAND—82-7075C) Dynamic behavior of a class of photovoltaic converters. Wasynczuk, O. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 30p. (CONF-820134—2). NTIS, PC A03/MF A01. Order Number DE82019344.

From IEEE Power Engineering Society winter meeting; New York, NY, USA (30 Jan 1982).

The perturb and observe peak power tracker operates by periodically incrementing or decrementing the array voltage. If a given perturbation leads to an increase or decrease in array power, the subsequent perturbation is made in the same or opposite direction respectively. Thus the peak power tracker continuously hunts or seeks peak power conditions. The dynamic behavior of a specific photovoltaic design which utilizes the perturb and observe method of peak power tracking is discussed. It is shown that when the insolation does not vary with time, the perturb and observe method is able to converge to peak power conditions; however, when the insolation varies randomly at any substantial rate, the perturb and observe method fails to adequately track the peak power conditions. An alternate method of power tracking is examined which utilizes the harmonic components of the array voltage and current to establish proper control action. The performance of this method as compared to the perturb and observe method is demonstrated using a detailed hybrid simulation of the photovoltaic system. The design of the photovoltaic system and the detailed simulation of the various system components are described. (LEW)

56567 (SAND—82-7118) Design, performance, and economic evaluation of photovoltaic application experiments. Executive summary. (BDM Corp., Albuquerque, NM (USA)). May 1982. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01. Order Number DE82015641.

The Mt. Laguna photovoltaic cell failure analysis, Commercial Application of a photovoltaic concentrator (CAPVC) collector trade-off study, and El Paso electric photovoltaic system analyses are summarized. Each summary presents the purpose, method of analysis, and results for each study. The mt. laguna study was to provide an understanding of the primary factors which can force individual solar cells or an array to be forced into reverse bias and eventual failure. The worst condition was determined to be partial shadowing of a single cell in a bypass group. The CAPVC study was to compare the performance of two linear parabolic collectors to determine the most cost effective collector and row count combination. The analyses of the El Paso system addressed optimum tilt angle for the array and fixed voltage, short circuit current variation, reverse bias cell temperature, and lightning and switching transients. (LEW)

56568 **Mead 25 kilowatt photovoltaic system.** Bucciarelli, L.L.; Cremin, J.D.; Fenton, H.A.; Hopkinson, R.F.; Lyon, E.F.; Romaine, W.R. (Massachusetts Inst. of Tech., Lexington). pp 16-21 of 13th Photovoltaic specialists conference: conference record. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

A 25 peak kW photovoltaic power system, presently the world's largest, has been installed at the University of Nebraska's Agricultural Research Station in Mead, Nebraska. The project goals include the collection of data on solar insolation, photovoltaic (PV) array performance, power conditioning equipment performance, and weather. A comprehensive system of sensors and data logging equipment has been installed for the purpose of collecting these data. The system allows for the automatic transmission of all accumulated data on a daily basis to Lincoln Laboratory in Lexington, Massachusetts, for reduction and analysis. The data are summarized which have been gathered on the array during its initial operating period.

56569 **Maximum power trackers for photovoltaic arrays.** Landsman, E.E. (MIT, Lexington, Mass.). pp 996-1000 of 13th photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From IEEE photovoltaic specialists conference; Washington, DC, USA (5 Jun 1978).

A maximum power point tracker can increase the time that a photovoltaic power system operates near the maximum power point of the solar array and this can increase the system energy output and enhance its economic value. A maximum power tracking system has been devised which is conceptually simpler than presently available trackers and can be simply implemented with digital logic. It is based on the observation that maximum power into most loads corresponds with maximum voltage or current. This paper establishes the theoretical background and presents the results of breadboard testing.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 56474, 57134, 57137

56570 **(DOE/ET/20385—1-Pt.2) Liquid metal cooled solar central receiver feasibility study and heliostat field analysis. Final report, Part II.** (Houston Univ., TX (USA). Energy Lab.). May 1978. Contract FG03-76ET20385. 379p. (ORO—5178-78-2). NTIS, PC A17/MF A01. Order Number DE82015439.

Portions of document are illegible.

Four studies are presented, the first two of which are based on a specific design for a water/steam commercial 100 MW/sub e/ Solar Tower System. The first of these uses the RCELL computer program, which provides a cellwise method for the economic optimization of central receiver systems, to compare performance for several latitudes, field slopes, tower heights, heliostat costs, land costs, and input figures of merit. Using the systems design studies for the 100 MW/sub e/ unit, the second study performs a detailed net energy analysis on capital energy required to build the thermal collection component, including 6 hours of storage. Also determined is the Energy Amplification Factor, which measures the number of times the energy incorporated in the plant can be replicated during its lifetime. The third study provides a means for calculating the sun's position as a function of time. The fundamental reference frames for observing celestial objects are defined, and basic notions of orbits and time reckoning are explained. Series solutions for the equation of time and for the equation of the center are given. Phenomena affecting the sun's position and the errors which result when their effects are disregarded are summarized. A computer program to accurately locate the sun was written. The effects that two different sun tracker programs have on insolation prediction are compared. The fourth study describes and models the sodium heat engine, a continuous isothermal expansion engine for sodium vapor. The heart of the machine is beta"-alumina, a refractory material remarkable for its high conductivity of sodium ions. (LEW)

56571 **(PNL—4003) Evaluation of solar-air-heating central-receiver concepts.** Bird, S.P.; Drost, M.K.; Williams, T.A.; Brown, D.R.; Fort, J.A.; Garrett-Price, B.A.; Hauser, S.G.; McLean, M.A.; Paluszek, A.M.; Young, J.K. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 140p. NTIS, PC A07/MF A01. Order Number DE82016924.

The potential of seven proposed air-heating central receiver concepts are evaluated based on an independent, uniform of each one's performance and cost. The concepts include: metal tubes, ceramic tubes, sodium heat pipes, ceramic matrix, ceramic domes, small particles, and volumetric heat exchange. The selection of design points considered in the analysis, the method and ground rules used in formulating the conceptual designs are discussed, and each concept design is briefly described. The method, ground rules, and models used in the performance evaluation and cost analysis and the results are presented. (LEW)

56572 **(SAND—81-1780) Designing the manifold piping for parabolic-trough-collector fields.** Sharp, J.K. (Sandia National Labs., Livermore, CA (USA)). Apr 1982. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01. Order Number DE82015998.

A simple procedure for sizing the manifold piping in parabolic-trough collector fields is presented. The proper manifold pipe sizes and insulation thicknesses are obtained without detailed optimizations of the thermal and electrical parasitics. An engineering constraint determines the pipe sizes and an insulation table lists the proper insulation thicknessess. The engineering constraint limits the pressure drop in the manifold piping to a fraction of the pressure drop in the ΔT string. This ensures output temperature control in all ΔT strings. A four-step procedure is presented to size the manifold piping; tables showing the proper insulation thickness as a function of pipe size and temperature are given.

56573 **(SAND—82-8220) Molten-nitrate-salt technology development. Progress report.** Mar, R.W.; Bradshaw, R.W.; Carling, R.W.; Goods, S.H.; Nagelberg, A.S.; Nissen, D.A. (Sandia National Labs., Livermore, CA (USA)). Apr 1982. Contract AC04-76DP00789. 48p. NTIS, PC A03/MF A01. Order Number DE82015867.

Portions of document are illegible.

A materials research program is being conducted to further the technologies associated with utilizing molten nitrate salts in solar thermal energy systems. Activities have addressed numerous concerns, including the absence of thermophysical and thermochemical data at high temperatures, an inadequate understanding of salt chemistry and how it relates to thermal stability and corrosion, and an inadequate understanding of corrosive interactions between the salt, containment alloys, and the thermal-mechanical environment. Progress made during FY1981 and the first quarter of FY1982 is reported.

56574 **Radiant energy collection and conversion apparatus and method.** Hunt, A.J. (to Department Of Energy). US Patent 4,313,304. 2 Feb 1982. Filed date 26 Jul 1979. vp.

PAT-APPL-061165.

The apparatus for collecting radiant energy and converting same to alternate energy form includes a housing having an interior space and a radiation transparent window allowing, for example, solar radiation to be received in the interior space of the housing. Means are provided for passing a stream of fluid past said window and for injecting radiation absorbent particles in said fluid stream. The particles absorb the radiation and because of their very large surface area, quickly release the heat to the surrounding fluid stream. The fluid stream particle mixture is heated until the particles vaporize. The fluid stream is then allowed to expand in, for example, a gas turbine to produce mechanical energy. In an aspect of the present invention properly sized particles need not be vaporized prior to the entrance of the fluid stream into the turbine, as the particles will not damage the turbine blades. In yet another aspect of the invention, conventional fuel injectors are provided to inject fuel into the fluid stream to maintain the proper temperature and pressure of the fluid stream should the source of radiant energy be interrupted. In yet another aspect of the invention, an apparatus is provided which includes means for providing a hot fluid stream having hot particles disbursed therein which can radiate energy, means for providing a cooler fluid stream having cooler particles disbursed therein, which particles can absorb radiant energy and means for passing the hot fluid stream adjacent the cooler fluid stream to warm the cooler fluid and cooler particles by the radiation from the hot fluid and hot particles.

1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

REFER ALSO TO CITATION(S) 58174

56575 **(AD-A—110459/5) Steady hydrodynamic loads due to vortex shedding from the OTEC cold water pipe. Final report.** Griffin, O.M. (Naval Research Lab., Washington, DC (USA)). 13 Jan 1982. 57p. (NRL-MR—4698). NTIS, PC A04/MF A01.

This report is limited in scope to consideration of the problems caused by vortex shedding from flexible, bluff cylinders in steady current flows, as these problems apply to the OTEC cold water pipe. In particular, the steady deflections caused by the amplified drag forces that accompany vortex-excited oscillations are considered. Emphasis placed upon the discussion of design methods, applications of these methods to practical problems, and comparison with available experimental data. A discussion is given of laboratory and field studies that have been conducted with model OTEC cold water pipes. Various devices that have been developed for the suppression of vortex-excited oscillations also are discussed. A comparison is made of the effectiveness of various suppresion devices and procedures, and practical approaches to implementing their application are presented. The implications of vortex-induced hydrodynamic drag and the suppression of vortex-excited oscillations in OTEC cold water pipe design are discussed briefly.

56576 **(PB—82-156878) OTEC mooring system development: recent accomplishments. Technical report.** Ross, J.M.; Wood, W.A. (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Ocean Technology and Engineering). Oct 1981. 24p. NTIS, PC A02/MF A01.

The mooring system for a floating OTEC platform consists of a seafloor foundation, a platform foundation, and a connecting line. This paper introduces the OTEC mooring system with a brief historical overview, reviews developmental work accomplished during the past year, and then presents a new look at life cycle costs for an example mooring system. Since June 1980, a significant effort within the OTEC Program has been directed toward the further development of mooring systems. The effort has included work leading to a better understanding of anchoring capabilities and problems, refinement of an existing mooring analytical model, a review of OTEC past mooring designs, and the production of a mooring system technology development plan. A major finding of the past year was a new upward estimate of mooring system lifetime costs as a result of downward-revised estimates of wire rope service life.

56577 **Design of 40-mw grazing and moored OTEC pilot/demonstration plants.** Richards, D.; George, J.F.; Seward, J.S. (Johns Hopkins Univ, Laurel, Md). *Journal of Energy;* **5**: No. 4, 224-230(Jul-Aug 1981).

Designs are presented and discussed for a plantship that cruises the tropical oceans, where the electrical energy generated by ocean thermal energy conversion (OTEC) is used to produce ammonia, replacing natural gas used in ammonia manufacture; and for a moored OTEC plant from which the electrical power is transmitted by undersea cable to an offshore island. 14 refs.

56578 **(ATR—78-7699-01-3-Vol.1) Ocean thermal energy conversion (OTEC) cost and performance simulation and analysis. Volume I. Study overview.** McKoy, G.C.; Reid, R.W. (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Sep 1978. Contract AT03-76ET20447. 60p. NTIS, PC A04/MF A01. Order Number DE82012420.

The results of a simulation and analysis of OTEC system performance and operating economics are summarized. Described are the simulation techniques which have been developed and the results of applying these techniques to determine achievable levels of performance and operating economics for OTEC systems operating at selected sites.

56579 **(ATR—78-7699-01-3-Vol.2) Ocean thermal energy conversion (OTEC) cost and performance simulation and analysis. Volume II. Engineering manual.** (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Sep 1978. Contract AT03-76ET20447. 100p. NTIS, PC A05/MF A01. Order Number DE82012421.

Portions of document are illegible.

OTECOST is a computer model of OTEC performance and cost developed as a systems analysis tool in support of OTEC mission analysis and planning studies. Most of the OTECOST simulation models are described. Power plant and transmission system performance models are described, followed by direct cost, cost adjustment, and economic analysis models. Details are given of the two modes currently available - alternating current electricity and direct current electricity. The system direct cost models for the power plant and transmission systems are presented, and adjustments to the calculated equipment costs are described. The economic evaluation of a given power plant/transmission system configuration is described wherein the capital/product flow schedule is evaluated over the plant lifetime in determining the net power production economics. The current OTECOST simulation is documented. (LEW)

56580 **(ATR—78-7699-01-3-Vol.3) Ocean thermal energy conversion (OTEC) cost and performance simulation and analysis. Volume III. User's manual.** (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Sep 1978. Contract AT03-76ET20447. 43p. NTIS, PC A03/MF A01. Order Number DE82012422.

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The computer model OTECOST was developed to compare OTEC systems costs for various design alternatives and siting options. After an overview of the OTECOST software, the general software features are described, the organization of the engineering models are described, and the function of each model is discussed. The input data specification procedure is described, defining all input items. The output format is described. (LEW)

56581 **(ATR—78-7699-01-3-Vol.4) Ocean thermal energy conversion (OTEC) cost and performance simulation and analysis. Volume IV. Appendix.** (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Sep 1978. Contract AT03-76ET20447. 230p. NTIS, PC A11/MF A01. Order Number DE82012423.

Portions of document are illegible.

Included are: the OTECOST program listing, sample case input and output data listings, a list of symbols, and the OTECOST validation flow. (LEW)

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 56620, 57125, 57125, 57130, 57131, 57131, 57185, 57191, 57197, 57197, 57199, 57242

56582 **(AD-A—110189/8) A passive solar retrofit study for concrete block buildings. Report for Oct 80-Sep 81.** Wray, W.O.; Miles, C.R.; Kosiewicz, C.E. (Los Alamos Scientific Lab., NM (USA)). Jan 1982. 28p. NTIS, PC A03/MF A01.

A passive solar retrofit study has been conducted for the Navy at the Los Alamos National Laboratory. The purpose of the study was to determine the energy savings obtainable in concrete block buildings from several passive solar heating and conservation strategies. A procedure involving the use of test cell data and computer simulation was employed to assess the merits of six retrofit options. The six strategies selected were chosen on the basis of providing a series of options that will deliver increasing energy savings at the cost of correspondingly increased levels of commitment.

56583 (AD-A—110976/8) Generalized procedure for assessing the inclusion/non-inclusion of passive solar techniques in facility design. Thayer, A.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1976. 136p. (AFIT-LSSR—79-81). NTIS, PC A07/MF A01.

Thesis.

Consideration of inclusion of solar energy concepts into the design of new facilities is mandatory for Air Force planners under current public law. Some guidance has been provided to Air Force planners, mainly within the Life-Cycle Costing Manual for the Federal Energy Management Programs. However, no complete procedure exists for performing an economic feasibility study of passive solar concepts. This thesis proposes a procedure for assessing the economic feasibility of passive solar concepts versus conventional construction. Utilizing the proposed procedure, an actual study was done for the proposed MX MFH units. The study revealed that a conventionally designed MFH unit had a lower life-cycle cost than the analyzed passive designs, over the facility's projected 25 year life. The procedure utilized for the actual study was used as a guide to identify the factors that an Air Force planner needs to make sound fiscal decisions on the inclusion/non-inclusion of passive solar techniques in facility designs. One passive concept not investigated due to insufficient data was the so-called double-shell design, which, if functions as claimed, would eliminate the need of any heating or cooling equipment. Elimination of this equipment could quite possibly make this passive concept economically feasible for facility designs.

56584 (BNL—51463) Harnessing the sun for development: actions for consideration by the international community at the UN Conference on New and Renewable Sources of Energy for promoting the use of renewable energy in developing countries. (Brookhaven National Lab., Upton, NY (USA); Teknekron, Inc., Berkeley, CA (USA)). Aug 1981. Contract AC02-76CH00016. 195p. NTIS, PC A09/MF A01. Order Number DE82020273.

The technical and economic evidence is reviewed for solar industrial process heat, highlighting the fact that financial parameters such as tax credits and depreciation allowance play a very large role in determining the economic competitiveness of solar investments. An analysis of the energy (and oil) consumed in providing industrial process heat in a number of selected developing countries is presented. Solar industrial process heat technology is discussed including the operating experience of several demonstration plants in the US Solar ponds are also described briefly. Financial and economic analysis of solar industrial process heat systems under different assumptions on future oil prices and various financial parameters is described. Financial analyses are summarized for a solar industrial process heat retrofit of a brewery in Zimbabwe and a high efficiency system operating in financial conditions typical of the US and a number of other industrialized nations. A set of recommended policy actions for countries wishing to enhance the commercial feasibility of renewable energy technologies in the commercial/industrial sector is presented. Various barriers and remedies to development of solar process heat are discussed including the potential role of international financial institutions such as the World Bank and the regional development banks. The issues of test and certification procedures for solar equipment, establishment of standards, and the training of personnel are analyzed. (LEW)

56585 (CONF-811109—5) Passive cooling for hot humid climates. Akridge, J.M.; Benton, C.C. (Georgia Inst. of Tech., Atlanta (USA). Coll. of Architecture). 1981. Contract AC02-79CS30238. 5p. NTIS, PC A02/MF A01. Order Number DE82016231.

From 1981 international passive and hybrid cooling conference; Miami Beach, FL, USA (11 Nov 1981).

Earth Tempering is a term presently used for structures which are either buried or semi-buried. These structures typically use the ground as an insulating element and as a high capacitance barrier for the dynamic attenuation of heat flux. In the proper environmental context, an earth tempered building can perform quite well. Unfortunately, underground buildings can be expected to meet considerable market resistance due to a number of factors. These include an increase in construction costs, waterproofing criteria, excessive site modifications and mass public resistance to subterranean housing. This has led to a possible cooling concept which the authors call Detached Earth Tempering (DET). The scheme involves an intimate but indirect coupling of selected building elements to the earth as a heat sink. Successfully applied, the concept promises the advantages of below-ground earth tempered construction without the structural, moisture, site and cost liabilities usually associated with below-grade buildings. The advantages and disadvantages of Detached Earth Tempering are addressed and a research program is described which is currently investigating the concept. Data are presented on measured performance and predicted performance.

56586 (DOE/BP—125) Solar home show: homes designed for the solar homebuilders program. (USDOE Bonneville Power Administration, Portland, OR). Jul 1982. 23p. NTIS, PC A02/MF A01. Order Number DE82020255.

Ten passive solar homes are presented that resulted from a program to demonstrate that passive solar homes can be attractive, affordable, functional, and therefore, marketable. For each home is given: the designer and builder, floor plans, perspective of the outside, passive solar and conservation features, and a comparison of the estimated heating bill for the house and a conventional house the same size. A brief discussion is included on the basics of passive solar design, ventilation and cooling, and solar access. (LEW)

56587 (DOE/CS/32166—T1) City of Scottsdale Courts Building solar space-conditioning project. Final technical report. (Scottsdale, City of, AZ (USA); Sullivan and Masson, Inc., Phoenix, AZ (USA)). Jun 1981. Contract FC03-78CS32166. 85p. NTIS, PC A05/MF A01. Order Number DE82008663.

Portions of document are illegible.

The Maricopa County Courts Building is an existing 6800 square foot, single story structure housing offices and courtroom space. The solar system is sized to provide 65% of the annual cooling load and 100% of the heating load. An adjacent city swimming pool is connected to the system as a heat sink to provide thermal overload protection. A 25-ton absorption chiller is piped in series with the existing 25-ton air-cooled packaged chiller. Heating will be by standard hot water duct coils mounted upstream of the existing electric heaters. Freeze control is by recirculation under normal conditions, and by flush through in the event of power failure. The control sequence is given and the acceptance tests are described. Problems and solutions in constructing the system and lessons learned are discussed. Appended are the solar system schematic and as-built drawings, as well as photographs of the completed project. (LEW)

56588 (DOE/CS/34146—T1) Passive-solar-retrofit, Pfister residence. Final report, May 7, 1979-September 1, 1980. Pfister, P. (Architectural Alliance, Inc., Minneapolis, MN (USA)). 1 Sep 1980. Contract FG04-77CS34146. 62p. NTIS, PC A04/MF A01. Order Number DE82014677.

Portions of document are illegible.

A passive solar retrofit was designed using a solarium and phase change storage rods. Also included are motor driven movable insulation and a limited exposed duct air distribution system that recirculates warm air from the second floor ceiling to the north side of the first floor. The house is monitored to assess the effectiveness and behavior of the various passive system components and to estimate the overall system performance. The retrofit was installed, and, together with weatherization, is expected to reduce overall space heating needs by approximately two-thirds. The building load, passive solar contribution, and costs are analyzed. (LEW)

56589 (DOE/ET/23112—1) Feasibility study of a solar-and-wind-powered desalinization device (SOWIDE). Final report. Garstang, M.; David, D.C.; Snow, J.W. . (Simpson Weather Associates, Charlottesville, VA (USA)). Jun 1980. Contract AC06-79ET23112. 98p. NTIS, PC A05/MF A01. Order Number DE82020042.

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The scope, need and feasibility of a solar-wind desalinization (SOWIDE) system is examined. A climatological study shows the scope and need where a water deficit, a saline source and solar and wind power coincide. Representative stations around the globe serve as examples. When climatological data are used, relatively few locations meet all requirements. Optimization of wind and solar energy through careful site selection would, however, greatly extend the use of an alternate energy powered desalinization system such as SOWIDE. The technical feasibility of SOWIDE is described in terms of the conceptual design which uses solar energy to heat impounded water, saturating a volume of air above the impoundment at the temperature of the water. The water vapor is extracted by condensation through a wind powered refrigerator. Latent heat is returned to the impoundment by the refrigerator fluid with additional heat provided by a pre-heater using heat from the brine discharge and by a resistance heater or stirrer driven by the wind generator. The important considerations of the design include the joint use of solar and wind power, optimization of the heat balance and the fact that the system operates at a low temperature which inhibits scaling and efficiency losses. Results show that the system will deliver $1\ m^3\ d^{-1}$ of fresh water at operating temperatures of 42 to 70°C. At an operating temperature of 60°C, the total power required is about 8 kW, equally partitioned between the solar and wind inputs. The operating temperatures and power requirements suggest that the SOWIDE system is technically feasible. Application of the system must await the testing of a prototype and an economic study.

56590 (DOE/R5/10223—3) **Midwest appropriate-technology small grants program. Semiannual technical progress report.** Hert, A. (Indiana Laborers' Training Trust Fund, Bedford (USA)). 26 Apr 1982. Contract FG02-80R510223. 19p. D. Order Number DE82019268.

Portions of document are illegible.

Four experimental air collectors are described with supporting test data given. Revisions to the air handling equipment and to the storage bin are described. A system for monitoring or control of the heating system is also described. A combination air-liquid collector has been constructed and experimented with to determine if an absorber plate with circulating liquid would substantially raise the surrounding case temperatures. Temperature data for this collector are also recorded. Some conclusions drawn from experiments with the described equipment are given, and a solar installation proposed for a maintenance building is described briefly. (LEW)

56591 (DOE/R5/10323—1) **Columbus Zoological Gardens feasibility study for a solar greenhouse at the Columbus Zoo.** (Columbus Zoological Gardens, Powell, OH (USA)). 28 Apr 1982. Contract FG02-81R510323. 26p. NTIS, PC A03/MF A01. Order Number DE82019930.

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A feasibility study is being conducted to determine if it is possible to design a 100% fossil fuel free greenhouse 1/3 acre in size. Three principle sources of renewable energy will be used: solar energy, methane digestion, and ground water for preheat. The steps taken to achieve a preliminary design are flow charted. An engineering analysis of the greenhouse design is presented. Dimensions for the greenhouse are given and a NOAA climatological data summary is included for Columbus, Ohio. Also included is a preliminary design layout, distribution of heat load, winter design heat loads, and monthly heating loads. A set of drawings is included. (LEW)

56592 (LA-UR—82-2040) **Use of an atrium for the passive-solar retrofit of an office building: design and installation experience.** Hunn, B.D.; Peterson, J.L. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 8p. (CONF-820733—1). NTIS, PC A02/MF A01. Order Number DE82019561.

From Designing and managing energy conscious commercial buildings conference; Denver, CO, USA (19 Jul 1982).

A clerestory window system has been installed over a courtyard in an existing two-story office building/museum at the Los Alamos National Laboratory, thus creating an atrium. This atrium serves as a passive solar heating and daylighting system for the building and provides new display space for the museum. The retrofit consists of a roof-mounted clerestory window system with night insulating shutters which: forms an atrium that provides new museum space, buffers the former courtyard walls and windows, preheats ventilation air for the entire building, and provides daylighting and heating for the new museum space. The passive system is coupled to the heating, ventilating, and air-conditioning (HVAC) system of the surrounding building by inducing fresh-air makeup through the solar-tempered atrium; heating, cooling, and daylighting are addressed in the design. The design process, the use of the DOE-2 building energy analysis computer program during design, and the construction of the atrium are described.

56593 (MASEC-CF—81-096, pp 1-17) **Interaction between electric utilities and the solar energy community on residential solar applications.** Anderson, D.E. (Mid-American Solar Energy Complex, Minneapolis, MN). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

After a brief illustration of the process of commercialization, the potential for application of conservation and renewable energy in the Mid-American region in particular and for the nation overall is assessed. For the Mid-American region, it is estimated that 240,000 new jobs would be created by using enough renewable energy to displace 7 quads by the end of the century. The Solar 80 design-build project is described, as are several conservation and renewable energy related products. (LEW)

56594 (MASEC-CF—81-096, pp 18-25) **Electric utilities involvement in active solar energy systems for residential space and water heating.** Zimmerman, O.F. (Electric Power Research Inst., Palo Alto, CA). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

After a review of reasons for utility involvement in customers' energy end-use options, research efforts by the Electric Power Research Institute are summarized. Areas of emphasis include efficient use of energy, load management and solar heating and cooling development. Activities impacting residential active solar space and water heating are highlighted. (LEW)

56595 (MASEC-CF—81-096, pp 27-35) **Tennessee Valley Authority Solar Residential Program.** Steffy, R.C. Jr. (Tennessee Valley Authority, Chattanooga). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Under a demonstration program in Memphis, Tennessee including the design, installation, inspection, and low-interest financing of 1000 solar water heaters, a feasibility study would be performed at the customer's request, a unit would be installed by crews that had completed TVA-accredited training courses and would be inspected, and the customer would be eligible for a 20-year loan with an interest rate of 3.37% with no downpayment. The loan would be repaid through the local power distributor's electric bill at the rate of $13 per month, $12 of which applied to the system, and the remaining $1 of which applied to a routine service contract. An updated program provides consumers with a list of TVA-approved water heating systems and installers that ranks the performance of each system as it was independently tested. Another program is the construction of 35 passive solar homes with permanent financing available through TVA at 11.78%, and with an incentive of $2500 in return for which energy monitoring equipment is installed and the homes can be used for the first year for demonstration purposes. Another home construction and demonstration program is targeted for the medium income customers, and a retrofit program is described. Another program discussed is a wood heater program. (LEW)

56596 (MASEC-CF—81-096, pp 65-107) **Electric utilities' involvement with passive solar residential applications.** Roberts, P.L. (Pennsylvania Power and Light Co., Allentown). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Passive solar heating and differences between passive and active solar systems are discussed. Optimizing the design of a building to use solar energy is emphasized. Customer benefits of passive design and life cycle cost comparisons of passive vs active systems are illustrated. Potential benefits (to utilities) of passive homes for winter and summer peaking are described as well as possible avenues of utility involvement (research/demonstration, financing, rate incentives, grants, etc.). Pennsylvania Power and Light Company's passive research project (begun in 1973) is described in some detail. Resrearch and development on glazings, insolation, house design, solar architecture, thermal insulation, Trombe walls, thermal mass effectiveness, solar domestic hot water heaters, and surface finishes are discussed. Six demonstration houses, four of which are re-designs and two are new designs, are discussed and illustrated. (MJJ)

56597 (MASEC-CF—81-096, pp 128-145) **Kansas City Power and Light Company's Passive Solar Homes Test Program: how it was planned and implemented.** Bailey, L.F. (Kansas City Power and Light Co., MO). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

The design and construction of a passive solar home in Overland Park, Kansas is described. The program was initiated to educate the public concerning the correct way to utilize solar energy. Intentionally, the house (2200 ft^2) was designed to not look solar, and its performance could be compared to a conventional house (oriented in the same direction) across the street. A complete thermal insulation and, basically, a complete building envelope program were employed. Features described include a vaulted ceiling, superinsulation, airtight vestibules, clerestory windows, earth-berming on the north side, 220 ft^2 of south-facing glazing, a solar atrium, an active solar water heating system, a computer control and comparison system, and thermal storage. It is concluded that the solar house uses 30% less energy for heating and cooling compared to the conventional house at a cost of $3800 (payback period of 11.7 years). Improvements and future plans are discussed briefly. (MJJ)

56598 (MASEC-CF—81-096, pp 146-157) **Methodology to determine the impact of passive solar on the electric utility industry.** DeDuck, P.F. (JBF Scientific Corp., Wilmington, MA). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

An overview of the utilities impacts methodology based on thermal performance, diversified electrical demand, and change in residential demand is presented leading to: (1) impacts on production cost; (2) impacts on system load; and (3) impacts on generating capacity. Thermal performance, diversified electrical demand, and cumulative change in residential demand are treated separately and it is shown how the impacts may be evaluated. (MJJ)

56599 (NP—2904442) **Passive-solar-design handbook for Wisconsin.** Steege, D.; Keiffer, B.; Tipler, G. (Wisconsin Dept. of Local Affairs and Development, Madison (USA); Wisconsin Energy Extension Service, Madison (USA); Wisconsin Univ., Madison (USA). Extension). Dec 1981. 40p. (E—3102). Agricultural Bulletin Building, 1535 Observatory Drive, Madison, WI 53706 $2.38.

The principles, definitions, and detailed calculations needed to design and evaluate passive solar systems are presented. The types of systems, principles of heat loss and heat gain, definitions of relevant terms and concepts, and the initial calculations later used to determine the annual solar savings fraction are introduced. The detailed climatic data, modification curves, and monthly solar savings fractions for various Wisconsin locations are given that will be used in the calculations. (LEW)

56600 (PB—82-161431) **Research and demonstration facilities for energy conservation and solar heating in the home. Final report.** Newman, J.O.; Godbey, L.C.; Davis, M.A.; Ezell, D.O. (Clemson Univ., SC (USA). Agricultural Experiment Station). 15 Oct 1981. 98p. NTIS, PC A05/MF A01.

This is a report on the design, testing and evaluation of two prototype solar homes constructed by the Clemson University Agricultural Experiment Station. The first prototype is a greenhouse-residence designed with 6-in. wall cavities (to increase insulation thickness), a 381 sq. ft. solar collector used primarily for space heating, and a greenhouse that was utilized as a solar collector for growing vegetables. The house does feature a domestic hot water preheating system and an electrical resistance back-up heating system. The second prototype is an earth-insulated house' designed primarily to study the physical features of the house in relation to the soil around it and the thermal interaction between the soil and the house environment. This house features a high temperature air collector that is used for domestic water heating. A special effort was made to have adequate daylight in the solar-earth house. A special study has been conducted on the geometric configuration of the rock storage and the methods of admitting air to the rock storage.

56601 (PB—82-175613) **National residential passive solar energy performance tables.** Oswald, R.; Gruber, J. (Total Environmental Action, Inc., Harrisville, NH (USA)). Aug 1981. 446p. NTIS, PC A19/MF A01.

These National Residential Passive Solar Energy Performance Tables have been developed for HUD so that annual net energy savings from residential passive systems could be determined for any location within the country. The tables are applicable to residential buildings containing one to four dwelling units, for both newly constructed passive buildings and buildings where the passive systems have been retrofitted on to an existing structure. The energy savings represent average performance of various passive solar energy systems in typical residential buildings. The values are therefore not precise for a particular building and should not be used as a tool in evaluating a specific passive system design. Energy savings listed in the tables combine the annual heating energy savings as well as the incremental annual cooling load penalty caused by the passive solar energy systems. The procedures used for determining the energy savings are described for both new residential construction and retrofit passive systems. The assumptions and methods used in constructing the tables are described, and examples of the procedures for various types of systems are given. Energy savings for retrofit passive systems are determined by either of two different procedures depending on whether or not the retrofit system adds to the heated living area of the building. Tables are given for each procedures: Tables for New Residential Construction and the Tables for Retrofit Systems. Diagrams and 14 references re provided.

56602 (PB—82-180845) **Residential solar data center: data resources and reports. Final report Sep 79-Sep 81.** Christopher, P.M.; Houser, A.O. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Oct 1981. 67p. (NBSIR—81-2369). NTIS, PC A04/MF A01.

The Residential Solar Data Center (SDC) was responsible for the establishment and operation of a computerized data base containing non-instrumented residential data collected from the DoE/HUD Solar Heating and Cooling Demonstration Program. This document includes a summary of the history and background of the SDC and its role in the demonstration program, a list of the final computer reports which are available, sample pages of representative reports, and a description of the data files which comprised the solar data base.

56603 (PB—82-180910) **Residential Solar Data Center: grant reports.** Christopher, P.M.; Charlton, L.L. (National Measurement Lab. (NBS), Washington, DC (USA)). Sep 1981. 145p. (NBSIR—81-2376). NTIS, PC A07/MF A01.

The Residential Solar Data Center project staff in the Center for Building Technology, National Bureau of Standards, has been responsible for the establishment and operation of a computerized data base containing non-instrumented residential data generated by the Solar Heating and Cooling Demonstration Program sponsored by the Department of Energy (DoE) and the Department of Housing and Urban Development (HUD). This document includes computer reports of data contained in the Grant file, one of six computer files comprising the data base. These reports contain data recorded on applications submitted to HUD by organizations or individual builders applying for grants to build solar energy systems in new and/or existing homes. Approximately 668 grants have been awarded in six award cycles.

56604 (SOLAR/0020—82/44) **Availability of solar energy reports from the National Solar Data Program.** (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). Jul 1982. Contract AC01-79CS30027. 69p. NTIS, PC A04/MF A01. Order Number DE82020052.

The various types of reports published by the National Solar Data Program are discussed, and the reports issued prior to July 15, 1982 are listed. The reports identified are segmented into ten types: monthly performance reports, solar energy performance evaluation reports, solar performance bulletins, solar bulletins (covering a specific topic), environmental data reports, solar project description reports, solar project cost reports, program information reports, comparative reports, and reliability and material assessment reports. Order blanks are provided for obtaining copies of the reports. (LEW)

56605 (WAOENG—82-11) **Passive solar energy in Washington: results of the Washington passive solar design/build competition.** (Washington State Energy Office, Olympia (USA)). Mar 1982. Contract FG06-79R000003. 56p. NTIS, PC A04/MF A01. Order Number DE82020394.

The Washington Passive Solar Design/Build Competition was held in an effort to encourage the design, construction, and marketing of moderately priced passive solar homes in Washington state. Four categories were established, including single and multifamily, new design and remodel. A number of commonly made thermal mistakes are discussed. Eight winning entries are presented along with four notable entries, for each of which is given an overview of the design, energy conservation measures, passive heating and cooling features, system operation, and thermal performance. (LEW)

56606 **Solar energy/utility interface: technical issues.** Butt, S.H. (Sol Energy Ind Assoc, East Alton, Ill). *Energy (Oxford);* 7: No. 1, 5-13(Jan 1982).

Typical solar heating, hot water, and air-conditioning systems cannot provide all of the thermal energy required by a structure. Auxiliary or "backup" energy is supplied by public utilities. Energy storage capability usually provided as an element in such systems may be employed for utility load management purposes. Technical issues relating to this are explored, including the need for development of standards to optimize the interaction between the solar system and the utility, the effect of variability in the utility's load profile upon the interface, and the impact of the use of solar storage for load management on solar systems. Passive solar heating systems are technically diverse. Technical requirements for interfacing passive systems with utilities in an optimum manner are discussed. Suggested approaches to improvement of this interface are reviewed. One solution to successfully interfacing passive systems with utilities is the development of hybrid systems. This potential is explored.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 56519, 56521, 56590, 56660

56607 (DOE/ET/21008—T1) **Accurate glass forming for high-temperature solar applications. Final report.** (Suntec Systems, Inc., St. Paul, MN (USA)). Oct 1980. Contract AC01-79ET21008. 105p. NTIS, PC A06/MF A01. Order Number DE82014091.

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Development work was undertaken to thermally form glass for solar concentrators. Sagging and pressing glass to parabolic shapes was investigated with goal of achieving slope errors less than 2.0 mr RMS and costs of \$1.25/ft^2. In addition, a laminating process was investigated to overcome the problem of silvering of a curved surface and to reduce corrosion of the silver. Thermal sagging is a process in which glass is shaped by heating the glass until it is sufficiently soft to deform under its own weight and conform to a mold. For cylindrical parabolic shapes, a method for producing low cost high accuracy molds was developed using castable ceramics and a grinder. Thermal conditions were established for a commercial glass bending furnace to obtain good replication of the mold. The accuracy and cost goals were met for glass size up to 30 x 30 x 0.125 inches and for low iron and regular iron float and sheet glasses. Lamination of two curved pieces of glass using automotive technology was investigated. A silver film was placed between two layers of polyvinyl and butyral (PVB) and this was used to bond two sheets of glass. Economically, and technically, the process appears feasible. However, the non-uniform thickness of PBV cause distortion in the reflected image. More work is needed to assess accuracy of curved laminated composites. Thermal pressing of glass is accomplished by heating the glass until it is soft and mechanically stamping the shape. Equipment was built and operated to determine important parameters in pressing. Control of thermal stresses in the glass is critical to preventing cracks. No glass pieces were produced without cracks.

56608 (Juel-Spez—93) **Method for determining the effective heat capacity of therme flat plate collectors.** Schroeer, R.; Ungeheuer, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Dec 1980. 55p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

In the presented study different methods for heat capacity determination of therme flat plate collectors are described and experimentally investigated. The tests were performed on two commercial collectors produced by BBC/Sueddeutsche Metallwerke Walldorf and by SA Giordano/France. The collector from France was checked within a joint test programme of the European community. It could be shown that well reproducible results could be obtained by using the latter in detail described experimental technique called integration method. Experimental results and theoretical calcualtions were in good agreement for the investigated collectors. The comparison of the two different calculation methods (BSE and analytical method) shows that the BSE method despite a minimum of effort yields good results with a for practical application sufficient high accuracy.

56609 (PNL—4257) **Electroless nickel and ion-plated protective coatings for silvered glass mirrors.** Lind, M.A.; Chaudiere, D.A.; Dake, L.S.; Stewart, T.L. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Apr 1982. Contract AC06-76RL01830. 36p. NTIS, PC A03/MF A01. Order Number DE82015034.

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A preliminary examination of two methods of protecting second surface silvered glass mirrors from environmental degradation is presented. One method employed silver mirrors overcoated with Al, Ni, 304 stainless steel, Cr, or an Al/Cu alloy prepared by ion-plating. The other method used conventional wet process silver mirrors protected with a thin electroless nickel coating. No attempt was made to optimize the coatings for either method. These experimental mirrors were compared with conventional paint backed silver/copper mirrors after exposure to elevated temperatures and water vapor in order to estimate their relative environmental stability. The electroless nickel mirrors showed consistently more resistance to these stresses than either the conventional or ion-plated mirrors, suggesting that they may provide more durable field service.

56610 (PNL—4282) **Effect of exposing two commercial manufacturers' second-surface silver/glass mirrors to elevated-temperature, mechanical loading, and high-humidity environments.** Dake, L.S.; Lind, M.A. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Apr 1982. Contract AC06-76RL01830. 20p. NTIS, PC A02/MF A01. Order Number DE82013274.

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A preliminary examination of the effect of three accelerated exposure parameters on second surface silver/glass mirrors was performed. The variables studied were temperature (elevated and sub-zero), humidity and mechanical loading. One test consisted of exposing mirror coupons to dry heat (80°C) and heat plus water vapor (80°C, ~ 100% RH) environments. Another test consisted of subjecting mechanically loaded mirror strips to sub-zero temperature (-20°C), dry heat (80°C), and heat plus water vapor. Samples were evaluated qualitatively using dark field microscopy (1X and 100X). Quantitative determination of the effects of exposure testing on the mirrors was done with spectrophotometer spectral hemispherical and diffuse reflectance measurements. Degradation that was progressive with time was observed for mirrors exposed to dry heat and heat plus water vapor. The degradation did not have the same visual appearance for the two environments. Mechanical loading at -20°C produced no degradation after three months' exposure time. Mechanical loading in dry heat and heat plus water vapor environments resulted in mirror degradation that was the same as that found in unloaded mirrors exposed to the same temperature and humidity. These preliminary tests indicate that the dry heat and heat plus water vapor accelerated tests may provide useful information about mirror degradation, while the mechanical load tests do not. The microscopy and spectrophotometer reflectance measurements were both useful techniques for determining the extent of degradation.

56611 **(SAND—81-2083) Contact stresses on a thin plate after large displacements to a full parabolic surface.** Reuter, R.C. Jr.; Wilson, R.K. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1981. Contract AC04-76DP00789. 26p. NTIS, PC A03/MF A01. Order Number DE82005712.

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A solution is obtained for the determination of all loads necessary to hold an initially flat, thin, elastic plate in the shape of a prescribed parabolic surface, following large displacement. These loads include spatially varying normal tractions distributed over the back surface of the plate, and a uniform shear force and bending moment applied along the opposing edges which become the rims of the parabola after deformation. The plate represents a reflective surface which is mechanically deformed to the shape of, and bonded to a rigid, parabolic substructure to create a solar collector. After assembly, the normal stresses are those developed in the adhesive which bonds the reflective surface to the substructure. The absence of edge loads along the rims of an actual, formed reflective surface gives rise to local displacement and stress variations (edge effects) which are obtained through a separate solution. Numerical results for the normal stress distribution, local variations and loss of optical quality in the edge effect zone are included.

56612 **(SAND—82-0934) Solar hemispherical reflectometer modification for second-surface mirror measurement.** Mahoney, A.R. (Sandia National Labs., Albuquerque, NM (USA)). May 1982. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01. Order Number DE82016913.

A commercial reflectometer has been modified for improved measurement of the solar hemispherical reflectance of second surface mirrors. The Solar Spectrum Reflectometer (SSR), manufactured by Devices and Services Co., Dallas, TX is designed to measure the solar hemispherical reflectance of flat, diffusely reflecting and first surface specular samples. Initial investigation of the device revealed that the SSR yielded significant deviations from the actual solar reflectance of second surface mirrors. The low reflectance values were determined to be caused by the displacement of the reflective surface away from the measurement port caused by the mirror protective layer. Instrument modifications are described which reduce the sensitivity of the instrument to second surface mirror thickness. The modifications involve enlarging both the sample port opening and the specular disk (target) located inside the measurement cavity, adjusting the lamp assembly height, and installing a diffuser over the lamp. The modified SSR demonstrated only a small linear reflectance variation with mirror displacement. It was shown that any mirror of known solar hemispherical reflectance having a thickness within the range, 0 mm (first surface) to 3.2 mm, could be used as the reflectance standard. A variety of mirror samples, ranging from first surface to 6 mm thick, were measured using the modified SSR. All corrected measured SSR solar reflectance values were within +- 0.008 reflectance units (1.000 reflectance units = 100% reflectance) of the actual solar reflectance, as determined from laboratory hemispherical reflectance measurements.

56613 **(SERI/TP—255-1408) Photochemical degradation of polymeric coatings on mirrors as studied in situ using FT-IR reflection-absorbance spectroscopy.** Webb, J.D.; Schissel, P.; Czanderna, A.W.; Smith, D.M.; Chughtai, A.R. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1981. Contract AC02-77CH00178. 3p. NTIS, PC A02/MF A01. Order Number DE82006069.

Portions of document are illegible.

Reflection-absorbance spectroscopy has been used to obtain analytical information on samples of polymer/metal multilayer stacks subjected to degradative factors. The capabilities of the apparatus are summarized and representative data from initial studies are presented. (LEW)

56614 **Solar collector.** Wilhelm, W.G. (to Department Of Energy). US Patent 4,327,707. 4 May 1982. Filed date 20 Nov 1979. vp.

PAT-APPL-096260.

The field of this invention is solar collectors, and more particularly, the invention pertains to a flat plate collector that employs high performance thin films. The solar collector of this invention overcomes several problems in this field, such as excessive hardware, cost and reliability, and other prior art drawbacks outlined in the specification. In the preferred form, the apparatus features a substantially rigid planar frame. A thin film window is bonded to one planar side of the frame. An absorber of laminate construction is comprised of two thin film layers that are sealed perimetrically. The layers define a fluid-tight planar envelope of large surface area to volume through which a heat transfer fluid flows. Absorber is bonded to the other planar side of the frame. The thin film construction of the absorber assures substantially full envelope wetting and thus good efficiency. The window and absorber films stress the frame adding to the overall strength of the collector.

56615 **Ideal second stages in tandem with parabolic concentrators.** Kritchman, E.M. (University of Chicago Enrico Fermi Institute, Chicago, Illinois 60637). *Applied Optics;* **21**: No. 7, 1307-1309(1 Apr 1982).

Expressions for the concentration capability of parabolic reflectors are derived and extended to include additional ideal second-stage concentration. The ultimate concentration of a parabolic reflector (primary) alone is shown to achieve one-half of the ideal time in 2-D geometry; the respective two-stage configuration is shown to approach the ideal limit itself at large f/Nos.

56616 **Oxygen diffusion in vapor-deposited indium oxide films.** Wirtz, G.P.; Takiar, H.P. (Univ of Ill, Urbana, USA). *Journal of the American Ceramic Society;* **64**: No. 12, 748-752(Dec 1981).

Indium oxide has been considered as a promising material for solar collector reflectors. Diffusion measurements were made between 1000 and 1300 K on films of In/sub 2/O/sub 3/ by electrochemical techniques using an yttria-stabilized zirconia solid electrolyte. At atmospheric oxygen pressures, diffusion invariably occurred via an oxygen interstitial mechanism. The diffusion coefficient decreased with decreasing oxygen pressure. 33 refs.

56617 **Solar flux guides and systems employing the same.** Cobble, M.H.; Hays, R.A.; Hull, W.C. (to Dept. of the Army). US Patent Application 319,495. 9 Nov 1981. 16p.

Elongated, hollow flux guides are adapted to efficiently transport high density solar flux over relatively long distances. The guides may be cylindrical, curved, or conically shaped. The conical guides provide further concentration of the already concentrated solar flux. Systems including parabolic collectors and utilizing the novel flux guides to transport the flux collected thereby to a remote point of utilization are also disclosed.

56618 **Spectral radiometric measurements for high temperature solar applications.** Matthews, L.K. (Sandia Laboratories, Albuquerque, NM). pp 2-7 of Measurements of optical radiations. Field, H.P.; Zalewski, E.F.; Zweibaum, F. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1979).

From 23. annual international symposium of the Society of Photographic Instrumentation Engineers; San Diego, CA, USA (27 Aug 1979).

A net radiometer was used to obtain information concerning the radiative losses from the EPRI/Boeing 1-MW bench model solar receiver (BMSR). The instrument has a 0.3 to 2.0 micron spectral range and 15.5-milliradian field of view.

1420 Heat Storage

56619 (CONF-801203—, pp 11.25-11.26) **Overview and test results of the Department of Energy's electric vehicle battery program.** Webster, W.H. (Dept. of Energy, Washington, DC). 1980. NTIS, PC A99/MF A01.

From National conference on renewable energy technologies; Honolulu, HI, USA (7 Dec 1980).

56620 **Solar heating system.** Dorsey, G.F.; Schreyer, J.M. (to Department of Energy). US Patent 4,313,424. 2 Feb 1982. Filed date 16 May 1980. vp.

PAT-APPL-150394.

An improved solar heating system is disclosed in which the incident radiation of the sun is absorbed on collector panels, transferred to a storage unit and then distributed as heat for a building and the like. The improvement is obtained by utilizing a storage unit comprising separate compartments containing an array of materials having different melting points ranging from 75 to 180/sup degrees/ F. The materials in the storage system are melted in accordance with the amount of heat absorbed from the sun and then transferred to the storage system. An efficient low volume storage system is provided by utilizing the latent heat of fusion of the materials as they change states in storing and releasing heat for distribution.

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

56621 **Types of geothermal reservoirs.** Zais, E.J. (Elliot Zais & Associates, Inc., Corvallis, OR). *Geothermal Resources Council, Special Report;* No. 10, 7-10(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

Geothermal systems exist in several widely differing types from radiogenically heated sandstones to vapor-dominated hydrothermal systems in fractured granites sitting above cooling magma chambers to geopressured reservoirs. Geochemistry plays a large role in distinguishing among the different types. Some example systems of each type are (1) The Geysers CA-vapor-dominated, (2) Cerro Prieto Mexico-liquid-dominated, high temperature, (3) Klamath Falls OR-liquid-dominated, low to moderate temperature, (4) Fenton Hill NM-hot dry rock, (5) Texas Gulf Coast-geopressured geothermal, (6) Paris Basin France-sedimentary basin, (7) US East Coast-radiogenic.

1502 Geology And Hydrology Of Geothermal Systems

56622 **(DOE/ID/12079—57) Lithologic interpretation of the De Braga No. 2 and Richard Weishaupt No. 1 geothermal wells, Stillwater project, Churchill County, Nevada.** Sibbett, B.S.; Blackett, R.E. (Utah Univ., Salt Lake City (USA). Research Inst.). Feb 1982. Contract AC07-79ID12079. 38p. (ESL—70). NTIS, PC A03/MF A01. Order Number DE82019935.

Portions of document are illegible.

Lithologies penetrated throughout the upper 732 to 838 m (2400 to 2750 ft) within the Stillwater prospect area are terrigenous sediments of Pleistocene to Recent age. A sill of dacite to andesite composition with a thickness variable between 122 to 208 m (400 to 680 ft) is present below the terrigenous sediments. Between the base of the sill and the top of the Bunejug Formation are intercalated volcanic and sedimentary rocks. All formations overlying the Bunejug Formation are probably of Pleistocene age. The basalt and basaltic-andesite flows and ash below the depth of approximately 1128 m (3700 ft) are herein assigned to the Bunejug Formation (Morrison, 1964) of Pliocene and possibly early Pleistocene age. The Bunejug Formation is a thick sequence of basalt to andesite flows and hyaloclastite exposed in the mountains surrounding the south half of the Carson Desert. The De Braga No. 2 well bottomed in Bunejug volcanics at a depth of 2109 m (6920 ft). The Richard Weishaupt No. 1 well penetrated the entire Bunejug sequence and entered felsic volcanics and tuffaceous sediments, which possibly represent part of the Truckee Formation, at a depth of approximately 2412 m (7915 ft).

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 56640

56623 **(AD-A—109572/8) Heat flow studies, Coso Geothermal Area, China Lake, California. Technical report.** Combs, J. (Texas Univ., Dallas (USA). Richardson Inst. for Geosciences). 28 Feb 1975. 28p. NTIS, PC A03/MF A01.

Heat flow studies in the Coso Geothermal Area were conducted at China Lake, California. Temperature measurements were completed in nine of the heat flow boreholes. Temperatures were measured at five meter intervals from the ground surface to the deepest five meter interval. Subsequently, temperatures were remeasured two or three times in each borehole in order to demonstrate that equilibrium thermal conditions existed. The maximum difference in temperature, at any of the five meter intervals, was 0.03 deg C. Results from these boreholes, as well as from the other seven, indicate that the temperature data above 15 meters is useless for calculating the geothermal gradients. This is due to the effects of solar radiation at the surface of the earth.

56624 **(CONF-810572—) Geothermal potential of the Cascade Mountain Range: exploration and development. Special report No. 10.** (Geothermal Resources Council, Davis, CA (USA)). May 1981. 83p. NTIS, PC A05/MF A01. Order Number DE82018624.

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

Portions of document are illegible.

Eighteen papers are included, one of which was previously abstracted for EDB. A separate abstract was prepared for each of the remaining seventeen papers for Energy Research Abstracts (ERA); ten of the papers are included in Energy Abstracts for Policy Analysis (EPA).

56625 **(DOE/ET/27081—6-Vol.1) Prairie Canal Well No. 1, Calcasieu Parish, Louisiana. Volume 1. Completion and testing. Final report.** (Eaton Operating Co., Inc., Houston, TX (USA)). 1981. Contract AC08-80ET27081. 340p. NTIS, PC A15/MF A01. Order Number DE82006124.

Portions of document are illegible.

The Prairie Canal Company, Inc. Well No. 1, approximately 8 miles south of the city of Lake Charles, Louisiana, was tested through the annulus between 5-1/2 inch casing and 2-3/8 inch tubing. The interval tested was from 14,782 to 14,820 feet. The geological section was the Hackberry Sand, a member of the Oligocene Frio formation. Produced water was injected into a disposal well which was perforated in several Miocene Sands from 3070 to 4600 feet. Original plans were to test a section of the Hackberry sand from 14,976 to 15,024 feet. This primary zone, however, produced a large amount of sand, shale, gravel, and rocks during early flow periods and was abandoned in favor of the secondary zone. Four pressure drawdown flow tests and three pressure buildup tests were conducted during a 12-day period. A total of 36,505 barrels of water was produced. The highest sustained flow rate was approximately 7100 BWPD. The gas-to-water ratio, measured during testing, ranged from 41 to 50 SCF/BBL. There is disagreement as to the saturation value of the reservoir brine, which may be between 43.3 and 49.7 SCF/BBL. The methane content of the flare line gas averaged 88.4 mole percent. The CO_2 content averaged 8.4 mole percent. Measured values of H_2S in the gas were between 12 and 24 ppM.

56626 (DOE/ET/27081—6-Vol.2) Prairie Canal Well No. 1, Calcasieu Parish, Louisiana. Volume II. Well test data. Final report. (Eaton Operating Co., Inc., Houston, TX (USA)). 1981. Contract AC08-80ET27081. 532p. D. Order Number DE82006123.

Portions of document are illegible.

The following are included in appendices: field test data, field non-edited data, raw data, tentative method of testing for hydrogen sulfide in natural gas using length of stain tubes, combined sample log, report on reservoir fluids study, well test analysis, analysis of solids samples from primary zone, chemical analysis procedures, scale and corrosion evaluation, laboratory report on scale deposits, and sand detector strip charts. (MHR)

56627 Pressure buildup analysis of geothermal steam wells with a parallelepiped model. Economides, M.J.; Ogbe, D.; Miller, F.A.; Cinco-Ley, H.; Fehlberg, E.L. (Stanford Univ, Calif, USA). *Journal of Petroleum Technology;* **34**: No. 4, 925-929(Apr 1982).

Geothermal well testing, a discipline that evolved from conventional oil and gas well testing, often requires special considerations. The geometry of the reservoir and those characteristics frequently found in geothermal systems engendered the idea of a parallelepiped model with interpenetrating fractures. Such geometry can be described mathematically using Green's and source functions. Equations of reservoir pressure behavior then can be developed for both drawdown and buildup tests. Graphs describing dimensionless pressure as a function of time and various reservoir parameters are provided in this paper. The general method used is type-curve matching. 4 refs.

56628 Method and apparatus for determining vertical heat flux of geothermal field. Poppendiek, H.F. (to Department of Energy). US Patent 4,313,342. 2 Feb 1982. Filed date 11 Mar 1980. vp.

PAT-APPL-129433.

A method and apparatus for determining vertical heat flux of a geothermal field, and mapping the entire field, is based upon an elongated heat-flux transducer comprised of a length of tubing of relatively low thermal conductivity with a thermopile inside for measuring the thermal gradient between the ends of the transducer after it has been positioned in a borehole for a period sufficient for the tube to reach thermal equilibrium. The transducer is thermally coupled to the surrounding earth by a fluid annulus, preferably water or mud. A second transducer comprised of a length of tubing of relatively high thermal conductivity is used for a second thermal gradient measurement. The ratio of the first measurement to the second is then used to determine the earth's thermal conductivity, K infinity , from a precalculated graph, and using the value of thermal conductivity thus determined, then determining the vertical earth temperature gradient, b, from predetermined steady state heat balance equations which relate the undisturbed vertical earth temperature distributions at some distance from the borehole and earth thermal conductivity to the temperature gradients in the transducers and their thermal conductivity. The product of the earth's thermal conductivity, K infinity , and the earth's undisturbed vertical temperature gradient, b, then determines the earth's vertical heat flux. The process can be repeated many times for boreholes of a geothermal field to map vertical heat flux.

56629 Geothermal exploration: philosophy, methods, impacts, land positions and problems. Pilkington, H.D. *Geothermal Resources Council, Special Report;* No. 10, 1-6(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

Geothermal exploration consists of measuring geological, geochemical and geophysical parameters at the earth's surface. The measured parameters then must be interpreted in terms of a geothermal model for the Cascades to determine where and how deep one must drill for the geothermal resource. The exploration manager takes the technical data developed for a given prospect and determines whether it can be a business within the constraints imposed by corporate policy.

56630 Meager Creek geothermal project: an exploration case history. Fairbank, B.D.; Openshaw, R.E.; Souther, J.G.; Stauder, J.J. *Geothermal Resources Council, Special Report;* No. 10, 15-20(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The South Reservoir in the Meager Creek Geothermal Area is within crystalline basement rocks on the southern flank of the Pliocene to Recent Meager Mountain Volcanic Complex. Geological, geochemical and resistivity surveys were used to determine targets for temperature gradient diamond drilling. Temperature profiles indicate anomously high temperature gradients in drill holes M2, M3, M4, M6, M7, M8, M10, M11 and M12. Heat flow values of 105 to 620 mWm^{-2} (2.5 to 14.8 HFU) have been calculated for drill holes M2, M3, M7, M8, M11 and M12; these values are up to seven times the regional heat flow for the Garibaldi Volcanic Belt. The main South Reservoir thermal anomaly has been defined over an area about 3 km by 1 km in the Meager Creek valley and is open to the north and southeast. Deep drilling and production testing to assess the reservoir as a potential power source will be initiated during 1981.

56631 Mount Hood exploration, Oregon: a case history. Bowen, R.G. (Wy'East Exploration and Development Co., Portland, OR). *Geothermal Resources Council, Special Report;* No. 10, 21-24(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

An assessment program of Mount Hood is giving information useful for geothermal development in the area and is expected to characterize and aid in exploration of other Cascade volcanoes. These studies have shown the presence of thermal waters coming to the surface around the south flank of the mountain and subsurface flow in other areas. Geothermal gradient drilling shows the average heat flow in the area to be about two times normal increasing toward the summit. Two commercial exploration programs resulting in drilling are underway; Northwest Natural Gas is exploring the west side for direct utilization in the Portland area, and Wy'East is exploring near Timberline Lodge on the south flank. On the west side adequate temperatures have been found but the wells have not found enough permeability to be useful. At Timberline Lodge a 4000′ well appears to have sufficient temperature, but it has not yet been tested. Further exploration and testing will continue this summer.

56632 Geothermal potential of the Cascades. Youngquist, W. *Geothermal Resources Council, Special Report;* No. 10, 25-30(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The Cascades are a Pacific Rim andesitic volcanic plate junction chain exhibiting recent volcanism and large volumes of young volcanics. Fractures are abundant. Ample water and heat are demonstrated to be present to form geothermal systems. Geophysical anomalies in the Cascades are analogous to other areas of known commercial geothermal resources. Application of reasonable exploration logic clearly indicates that geothermal resources of substantial size will eventually be found in this region. A figure in the vicinity of 6000 megawatts electric equivalent is suggested as a minimum expected resource.

56633 Chemical logging of geothermal wells. McAtee, R.E.; Allen, C.A.; Lewis, L.C. (Edgerton, Germeshausen & Grier Inc, Idaho Falls, ID). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 225-235(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

Chemical logging was developed to permit identification of zones bearing geothermal water during drilling of geothermal wells. This technique consists of collection of circulation fluid samples at specified periods determined by drill-bit depth. These samples are analyzed for bicarbonate (HCO/sub 3//sup -/), Cl/sup +/ 31,F/sup +/31,Ca/sup ++/, and silicon dioxide (SiO/sub 2/). The results are plotted as a function of depth, and the resulting log indicates the presence of water-bearing structure. It was discovered that the ratio of Ca/sup ++/ and HCO/sub 3//sup -/ concentrations is a temperature indicator. It was also found that chemical composition changes precede structural changes. This report describes chemical logging of three wells at the Raft River geothermal site, Idaho. 3 refs.

56634 **Thermal techniques for characterizing magma body geometries.** Hardee, H.C.; Larson, D.W. (Sandia Natl Lab, Albuquerque, NM, USA). *Geothermics;* 9: No. 3-4, 237-249(1980).

The surface heat flux distribution resulting from emplaced magma bodies can be used to help characterize the magma source. Closed-form analytical solutions for the conduction heat transfer from various idealized magma geometries (dikes, sills, and spheres) are obtained using either the Schwarz-Christoffel transformation theorem (dikes and sills) or the 'method of images' with superposition (spheres). 14 refs.

1504 Legal And Institutional Aspects

REFER ALSO TO CITATION(S) 56624, 56652

56635 **(DOE/ET/27196—T7) Imperial County geothermal development. Quarterly report, April 1-June 30, 1982.** (Imperial, County of, El Centro, CA (USA). Dept. of Public Works). 1982. Contract FC03-79ET27196. 28p. NTIS, PC A03/MF A01. Order Number DE82019152.

Portions of document are illegible.

The activities of the Geothermal Office during the quarter are discussed, including: important geothermal events, geothermal waste disposal, a grant award by the California Energy Commission, the geothermal development meeting, and the current status of geothermal development in Imperial County. Activities of the Geothermal Planner are addressed, including permits, processing of EIR's, and other planning activities. Progress on the direct heat study is reported.

56636 **Geothermal policy of the State of California.** Brown, S. (California Energy Commission, Sacramento). *Geothermal Resources Council, Special Report;* No. 10, 57-60(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The California Energy Commission is the State agency responsible for formulating energy policy in California. Since its creation in 1975, the Commission has set forth in its Biennial Report to the Governor and the Legislature those policies, goals, and priorities which govern the State's future energy and electricity needs. This paper will address geothermal energy policy of the State of California in the context of these overall state energy policy goals. The current status of a geothermal development in California and state programs and policies to encourage maximum development of this indigenous, alternative energy resource are described.

56637 **Geothermal policy in Oregon.** Amedeo, P. *Geothermal Resources Council, Special Report;* No. 10, 61-64(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The need for geothermal exploration in Oregon, land leasing problems, and financial incentives are discussed.

56638 **Geothermal energy policy in Washington: an overview.** Bloomquist, R.G. *Geothermal Resources Council, Special Report;* No. 10, 65-68(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The state of Washington is actively engaged in establishing the institutional framework within which the geothermal industry can successfully develop. The Interagency Geothermal Development Council is working diligently to ensure access to both federal and state lands for geothermal exploration and development. The State Department of Natural Resources is presently considering what could well become the most innovative royalty schedule yet adopted in the United States. The Legislature also continues to play an active role. Legislation has been passed which provides utilities with a greater rate of return for geothermal projects. Property tax exemptions for renewable resources have been enacted; and, legislation favoring district heating and a state loan program are being considered.

56639 **Pacific Northwest Energy Conservation and Power Planning Act.** Hornor, J.G. (Bonneville Power Administration, Portland, OR). *Geothermal Resources Council, Special Report;* No. 10, 69-70(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The Pacific Northwest Electric Power Planning and Conservation Act gives Bonneville Power Administration new authority which may, under certain circumstances, facilitate the development of geothermal energy. This authority includes the purchase of output or capability of new energy projects affecting the Pacific Northwest's electrical supply, the funding of investigations of proposed projects, and the study of renewable resources outside the Pacific Northwest which might be used for the region's benefit.

56640 **USDA-Forest Service lands: geothermal situation.** Torrence, J.F. (Forest Service, Region 6, Portland, OR). *Geothermal Resources Council, Special Report;* No. 10, 71-74(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

From 1974 to 1981 Forest Service action on lease applications evolved generally as follows: National Forests, environmental impact statements, and environmental analysis. The present leasing situation and future plans are discussed briefly.

56641 **Current and pending federal legislation affecting geothermal energy development.** Stephens, R.C. *Geothermal Resources Council, Special Report;* No. 10, 75-78(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

A number of laws were passed in the last ten years to govern leasing, permitting, taxation, utility regulation, and other aspects of geothermal energy. These laws have removed uncertainties and established a predictable and favorable financial climate for geothermal resource development. A number of significant improvements to this body of legislation are likely to be enacted this year. The new legislation will be directed towards removing unnecessary regulatory delays and restrictions. Amendments to the Geothermal Steam Act, the Energy Tax Act of 1978, and the Clean Air Act are already being developed, and have excellent prospects for early enactment.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 56671

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 56059, 56646

56642 **(PB—82-162595) Occupational health assessment of the geothermal hydrothermal convection industry. Final report.** Zerwas, M.A.; Witwer, C.R.; Freeman, R.E.; Salazar, A.; Semrau, K. (SRI International, Menlo Park, CA (USA)). Sep 1979. 76p. NTIS, PC A05/MF A01.

This report presents the results of a literature review and data collected through personal contacts and a site visit to The Geysers, a geothermal electricity generating station in Sonoma County, California. The objectives of the study were to: (1) Acquire information on and assess the potential health and safety problems in the geothermal hydrothermal convection industry from the available literature, by contacting people working in the industry and related areas, and by conducting a walk-through survey of The Geysers. (2) Identify areas of research that should be undertaken to develop effective measures to ensure the health and safety of workers employed in this developing industry.

56643 **Environmental assessment of the proposed nonelectric application of geothermal resources at Desert Hot Springs, California.** Rosenberg, L. (JPL, Pasadena, Calif, USA). pp 41.1-41.18 of Proceedings of the American Nuclear Society, conference on environmental aspects of non-conventional energy resources - 2, topical meeting, 1978. St. Clair, A.E. (ed.). La Grange Park, IL; American Nuclear Society (1978).

From ANS meeting on environmental aspects of non-conventional energy resources; Denver, CO, USA (26 Sep 1978).

The environmental analysis which was performed in evaluating the various proposed geothermal demonstration projects at Desert Hot Springs is described. The methodology developed was quite unusual since none of the projects considered existed at the time of the study. Furthermore, the proposed applications ranged from heating and cooling residences to an aquaculture option. Thus, the environmental assessment could not address specific extant factors which could be weighed precisely. It had to be a broad-based study, yet one that still addressed itself to geothermal development. 12 refs.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 56538, 56657, 56658

56644 **(DOE/ET/27145—2) Computer simulation of noncondensible gas behavior in geothermal power plants utilizing direct contact heat exchange. Report of work, February 1, 1980-February 28, 1981.** Perona, J.J. (Tennessee Univ., Knoxville (USA). Dept. of Chemical, Metallurgical and Polymer Engineering). 1981. Contract AC03-78ET27145. 57p. NTIS, PC A04/MF A01. Order Number DE82012550.

Portions of document are illegible.

A computer model was developed to simulate the behavior of carbon dioxide and hydrogen sulfide in a geothermal power plant using direct contact heat exchange with isobutane as a working fluid. This computer program was modified to simulate the particular equipment characteristics of the 500 kW direct contact pilot plant at East Mesa. Vapor and liquid compositions and temperatures can be calculated throughout the heat exchangers in the pilot plant. The program is now available for analysis of the pilot plant operation and for design of similar plants.

56645 **(PB—82-151556) Water assessment of Heber commercial Geothermal Development program, Imperial County, California (Section 13C).** (Water Resources Council, Washington, DC (USA)). Jan 1981. 96p. NTIS, PC A05/MF A01.

The U.S. Water Resources Council, at the request of the U.S. Department of Energy, conducted an assessment of water needs, water availability and water resources impacts for the proposed 45 MWe Heber Binary Geothermal Demonstration Project in Imperial County, California.

56646 **(PB—82-163718) Heber Demonstration Plant geothermal binary electric power generation, Imperial County, California (13(B) water assessment report). Final report.** (Water Resources Council, Washington, DC (USA)). Sep 1980. 39p. NTIS, PC A03/MF A01.

This water assessment report prepared under the provisions of Section 13(b) is an assessment of water requirements and water supply availability for a proposed Geothermal Demonstration Plant near Heber, California. It discusses (1) principal findings, (2) project description, (3) water supply and availability, and (4) effects of the project.

56647 **Direct contact, binary fluid geothermal boiler.** Rapier, P.M. (to Department of Energy). US Patent 4,326,581. 27 Apr 1982. Filed date 27 Dec 1979. vp.

PAT-APPL-107791.

Energy is extracted from geothermal brines by direct contact with a working fluid such as isobutane which is immiscible with the brine in a geothermal boiler. The geothermal boiler provides a distributor arrangement which efficiently contacts geothermal brine with the isobutane in order to prevent the entrainment of geothermal brine in the isobutane vapor which is directed to a turbine. Accordingly the problem of brine carry-over through the turbine causes corrosion and scaling thereof is eliminated. Additionally the heat exchanger includes straightening vanes for preventing startup and other temporary fluctuations in the transitional zone of the boiler from causing brine carryover into the turbine. Also a screen is provided in the heat exchanger to coalesce the working fluid and to assist in defining the location of the transitional zone where the geothermal brine and the isobutane are initially mixed.

56648 **Performance characteristics of the Lysholm engine as tested for geothermal power applications in the Imperial Valley.** Steidel, R.F. Jr.; Weiss, H.; Flower, J.E. (Univ of Calif, Berkeley). *Journal of Engineering for Power;* **104**: No. 1, 231-240(Jan 1982).

This paper contains a description of the performance tests of a Lysholm engine completed at the Lawrence Livermore National Laboratory at the University of California. The Lysholm engine is a rotary displacement engine which can accept a low quality (vapor fraction) two-phase mixture. Generally, the well-head condition of geothermal fluids is a mixture of liquid and vapor, with quality up to 40 percent, although for most liquid dominated geothermal resources the vapor fraction is considerably less than 40 percent. 13 refs.

56649 **Utilization of geothermal energy for power production.** Lacy, R.G. (San Diego Gas and Electric Co., CA). *Geothermal Resources Council, Special Report;* No. 10, 31-34(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The preparation of electric utility peak and energy demand forecasts and the steps used to prepare supply forecasts to satisfy the demand forecasts are discussed. The selection of new power plant alternatives and the lack of data on binary and flash power plants which inhibit their selection are discussed. Attributes which, in the future, could favor geothermal power plants are identified.

56650 **Utilization of geothermal energy in a hybrid wood waste/geothermal power plant: engineering.** Staub, V.O.; Fogleman, S.F. *Geothermal Resources Council, Special Report;* No. 10, 39-44(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The implementation of heat from geothermal hot water into a 50 MW wood-fired electrical generating plant is investigated. Plant performance and fuel consumption parameters are compared for various system alternatives to establish the incentives for employing geothermal heat into the power generation process. Several areas for geothermal heat use are investigated and general conclusions are drawn in regard to the overall feasibility of each.

56651 **Honey Lake hybrid geothermal wood residue power project.** Toland, J. (Forest Service, San Francisco, CA). *Geothermal Resources Council, Special Report;* No. 10, 45-48(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The Honey Lake Hybrid Geothermal Wood Residue Power Project with a planned output of 50 MW is undergoing feasibility studies funded by GeoProducts Corporation, Department of Water Resources, State of California, US Department of Energy and the Forest Service, USDA. The outlook is optimistic. It is reliably estimated that the required volume of woody biomass can be made available without environmental degradation.

56652 **Governmental policies of the County of Lassen toward the utilization of geothermal resources.** Totten, M.A. *Geothermal Resources Council, Special Report;* No. 10, 49-52(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The interim geothermal policy adopted is presented. The environmental impacts of the Honey Lake hybrid geothermal power plant are discussed. A partial listing of the governmental organizations which must have input into geothermal decisions is given.

56653 Cost estimating for geothermal power systems. Schulte, S.C. (Battelle Pacific Northwest Labs., Richland, WA). *Transactions of the American Association of Cost Engineers;* 390-395(1978). (CONF-780710—).

From 22. American Association of Cost Engineers meeting; San Francisco, CA, USA (9 Jul 1978).

The capital cost estimating models used in GEOCOST are described. Cost models associated with piping transmission systems, power plant (binary and flashed steam cycle), and heat rejection systems are included. Described are methodologies used in the development of the models, sources of cost data and the applicability of the models to GEOCOST. Also described are comparisons made between GEOCOST generated estimates and industry planning group estimates. GEOCOST estimates are based on site characteristics equivalent to those of Albuquerque, New Mexico. Facility costs are estimated using component cost models. These cost models calculate installed costs for facility components as a function of operating parameters.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 56642, 56647

56654 (LA-UR—82-1971) Induced fractures: well stimulation through fracturing. Hanold, R.J. (Los Alamos National Lab., NM (USA); Republic Geothermal, Inc., Santa Fe Springs, CA (USA)). 1982. CONTRACT W-7405-ENG-36. 11p. (CONF-820834—2). NTIS, PC A02/MF A01. Order Number DE82019554.

From 3. AAPG circum-Pacific Energy and Materials conference; Honolulu, HI, USA (22 Aug 1982).

Portions of document are illegible.

Seven fracture stimulation treatments were planned and executed under the Department of Energy-funded Geothermal Well Stimulation Program. The objective of this program is to demonstrate that geothermal well stimulation offers a technical alternative to additional well drilling and redrilling for productivity enhancement which can substantially reduce development costs. Well stimulation treatments have been performed at Raft River, Idaho; East Mesa, California; The Geysers, California; and the Baca Project Area in New Mexico. Six of the seven stimulation experiments were technically successful in stimulating the wells. The two fracture treatments in East Mesa more than doubled the production rate of the previously marginal producer. The two fracture treatments at Raft River and the two at Baca were all successful in obtaining significant production from previously nonproductive intervals. The acid etching treatment in the well at the Geysers did not have any material effect on production rate.

56655 Method for inhibiting silica precipitation and scaling in geothermal flow systems. Harrar, J.E.; Locke, F.E.; Lorensen, L.E. (to Department Of Energy). US Patent 4,328,106. 4 May 1982. Filed date 13 Jun 1980. vp.

PAT-APPL-159313.

A method for inhibiting silica scaling and precipitation in geothermal flow systems by on-line injection of low concentrations of cationic nitrogen-containing compounds, particularly polymeric imines, polymeric amines, and quaternary ammonium compounds.

56656 Field tests of organic additives for scale control at the Salton Sea Geothermal Field. Harrar, J.E.; Locke, F.E.; Otto, C.H. Jr.; Lorenson, L.E.; Monaco, S.B.; Frey, W.P. (Lawrence Livermore Natl Lab, Calif, USA). *SPEJ, Society of Petroleum Engineers Journal;* **22**: No. 1, 17-27(Feb 1982).

A pilot-size brine handling system was operated from Magmamax Well 1 in southern California to study the characteristics of siliceous scale deposition and to evaluate the possibility of treating the brine with chemical additives to control scaling. The rates of formation, chemical constitution, and morphology of the scales were examined as functions of temperature, brine salinity, substrate material, and antiscalant additive activity. The most active classes of compounds were those containing polymeric chains of oxyethylene and polymeric nitrogen compounds that are cationic in character. The best single compound was Corcat P-18. 30 refs.

56657 Chemistry and materials in geothermal systems. Miller, R.L. (Edgerton, Germeshausen & Grier Inc, Idaho Falls, ID). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 3-9(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

The development of a geothermal fluid is traced, from its origin as meteoric water precipitating on the earth's surface, as it flows through the soils and rocks of geological formations, to the point where it returns to the surface as a hot spring, geyser, well, or other form. Water of magmatic origin is also included. The tendency of these hydrothermal fluids to form scale by precipitation of a portion of their dissolved solids is noted. A discussion is presented of types of information required for materials selection for energy systems utilizing geothermal fluids, including pH, temperature, the speciation of the particular geothermal fluid (especially its chloride, sulfide, and carbon dioxide content), and various types of corrosive attack on common materials. Specific examples of responses of materials to geothermal fluids are given. 8 refs.

56658 Material selection guidelines for geothermal power systems - an overview. Conover, M.; Ellis, P.; Curzon, A. (Radian Corp, Austin, TX). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 24-40(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

Results of work conducted for the U.S. Department of Energy are described. Process streams are identified by the presentation of nine geothermal power cycles applicable to four types of liquid-dominated geothermal resources found in the United States. Of the many constituents in geothermal fluids, seven key chemical species are identified that account for most corrosion phenomena in geothermal power systems. These species are: oxygen, hydrogen sulfide, carbon dioxide, ammonia, chloride, sulfate, and hydrogen ion concentrations. Based on analyses of actual geothermal materials test data and test methods, the performance of metals in geothermal fluid, steam, and condensate is presented for carbon and stainless steels, titanium, nickel, copper, and many other alloys. The applicability of new nonmetallic materials in geothermal systems is also addressed. Finally, the similarities and differences between seawater and geothermal corrosion phenomena are discussed. 28 refs.

56659 Application of linear polarization techniques to the measurement of corrosion rates in simulated geothermal brines. Danielson, M.J. (Battelle, Pac Northwest Lab, Richland, WA). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 41-56(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

The linear polarization or polarization resistance (PR) technique was investigated in high and low salinity geothermal brine at 150 and 250°C on a low-carbon steel (A53B) and a ferritic stainless steel (E-Brite 26-1) with and without the presence of oxygen in the brine. There was good agreement between the weight loss data and the linear polarization data. Oxygen generally accelerates the corrosion rate, and in the presence of oxygen the usual form of the polarization resistance equation must be replaced by the mass transfer equation to predict the correct corrosion rates. The results were compared with the corrosion rate determined by commerical PR instrumentation, and it was concluded that this instrumentation is adequate for field investigation in which oxygen is absent. However, when oxygen is present, the commerical instruments may underestimate the actual corrosion rate by a considerable amount. 12 refs.

56660 Corrosion protection of solar-collector heat exchangers and geothermal systems by electrodeposited organic films. Schnaper, G.H.; Koch, V.R.; Brummer, S.B. (EIC Corp, Newton, MA). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 57-68(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

Solar-collector heat exchangers normally experience temperatures up to 150°C (300°F), and stagnation temperatures may reach 200°C (400°F). Geothermal systems, in turn, often operate at temperatures near 250°C (480°F). Despite the presence of inhibitors, these high temperatures increase the corrosion rate of the metal to intolerable levels, thus reducing the lifetime of the system. It is found that by electrochemically depositing thin polymeric films on typical solar-collector and geothermal system materials (copper, iron, and aluminum), the corrosion rates can be substantially reduced. In particular, a 4-(p-hydroxyphenyl)-2 butanone polyphenylene oxide film subsequently treated with 2.4 dinitrophenylhydrazine on a mild steel substrate afforded minimal corrosion currents.

56661 **Preliminary evaluation of materials for fluidized bed technology in geothermal wells at Raft River, Idaho, and East Mesa, California.** Dirk, W.J.; Allen, C.A.; McAtee, R.E. (Exxon Nucl Idaho Co, Idaho Falls). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 69-80(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

Corrosion tests of candidate materials for heat exchangers using liquid fluidized bed technology were conducted at the U.S. Department of Energy's geothermal wells at Raft River, Idaho, and at the Geothermal Components Test Facility (GCTF) in East Mesa, Calif. These investigations deal with moderate temperature ranges of 135 to 163 /degree/C for electrical generation and nonelectrical applications. The corrosion, erosion, and scale buildup were evaluated. The average penetration of Type 1025 carbon steel was 314 /mu/m/year. Hastelloy alloys G and C276, stainless steels Type 304L, Type 316, Type 347, and Nitronic 50 has average penetrations of less than 2/mu/m/year. 7 refs.

56662 **Degradation of elastomers in geothermal environments.** Arnold, C. Jr.; Bieg, K.W.; Coquat, J.A. (Sandia Lab, Albuquerque, NM). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 155-163(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

The thermochemical degradation and sealing capability of various commercial O-rings in geothermal brine was evaluated at elevated temperatures and pressures to facilitate the selection of suitable elastomeric seals for the cable heads of geothermal logging tools. The extent of degradation was determined by measuring the change in tensile properties and glass transition temperatures that occurred as a result of exposure to brine at 548 K (275 /degree/C) and 34 MPa (5000 psi). All of the elastomers became degraded to some extent. The elastomers that retained some measure of elasticity and also were not breached by brine in seal tests were the perfluoroelastomers, ethylenepropylene rubbers, and a peroxide-cured fluoroelastomer. 11 refs.

56663 **Polymeric and composite materials for use in systems utilizing hot, flowing geothermal brine III.** Lorensen, L.E.; Walkup, C.M.; Pruneda, C.O. (Lawrence Livermore Lab, CA). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 164-179(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

Coatings and bulk specimens of high-performance polymers and composites were exposed to brine in the laboratory and in the field. Several levels of temperature and flow conditions were employed. Physical changes, scaling tendencies, and changes in surface characteristics resulting from exposure were studied by techniques including optical and scanning electron microscopy, energy-dispersive spectroscopy, and contact-angle measurements. Certain fluorocarbon and hydrocarbon polymers continue to respond favorably to the severe geothermal environment. Surface roughness, either present originally or developed during exposure, appears to be an important factor in promoting scaling and scale adhesion. 14 refs.

56664 **Concrete polymer materials as alternative materials of construction for geothermal applications - field test evaluations.** Fontana, J.J.; Zeldin, A.N. (Brookhaven Natl Lab, Upton, NY). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 180-193(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

The Brookhaven National Laboratory, Upton, N.Y., has been investigating the use of concrete polymer materials as alternative materials of construction for geothermal processes. To date, successful field tests have been demonstrated at the Geysers, Calif., the U.S. Bureau of Mines Corrosion Facility, Niland, Calif., and the Department of Energy Geothermal Facility at East Mesa, Calif. A survey of field and laboratory evaluations of concrete polymer materials that have been shown to be durable and economical as alternative materials of construction is described. 7 refs.

56665 **Mass discharge of a geofluid from a geothermal reservoir - well system with flashing flow in the bore.** Ryley, D.J. (Univ of Liverpool, Engl). *Geothermics;* **9**: No. 3-4, 221-235(1980).

In this analysis the reservoir and wellbore are treated as a single open system. By appealing to the conservation equations for mass, energy and momentum and identifying the components of pressure drop through the system the mass discharge is calculated in terms of the terminal conditions, parametric quantities and well constants. A numerical example is used to illustrate the respective effects upon the mass discharge of single and two-phase friction factor, wellhead pressure, phase slip and reservoir drawdown. 8 refs.

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 56651

56666 **(DOE/ET/27256—T10) Feasibility study of geothermal heating, Modoc Lassen housing project.** (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center; Davis Energy Group, CA (USA)). Nov 1981. Contract FG06-79ET27256. 26p. NTIS, PC A03/MF A01. Order Number DE82015099.

Portions of document are illegible.

This study evaluates the feasibility of using geothermal water for space and domestic water heating systems at the elderly housing project now ready for construction at the Modoc Lassen Indian Reservation. For the six units considered, the space heating load is four times the domestic water heating load. Since the geothermal water temperature is uncertain, two scenarios were evaluated. In the first, which assumes 160°F supply temperature, the geothermal system is assumed to satisfy the entire space and domestic water heating loads. In the second, which assumes the supply temperature to be less than 120°F at the wellhead only space heating is provided. The economics of the first scenario are quite favorable. The additional expenditure of $15,630 is projected to save $3522 annually at current energy costs, and the life cycle cost study projects a discounted rate of return on the investment of 44.4%. Surprisingly, the investment is even more favorable for the second scenario, due to the higher cost and lower resultant savings for the domestic water components. Forced air space heating from geothermal is recommended. Domestic water heating is recommended pending additional information on supply water temperature.

56667 **(DOE/ET/27256—T20) Basin View Geothermal Heating District, Klamath Falls, Oregon: conceptual design and economic-feasibility study report.** (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center; Center 4 Engineering, Redmond, OR (USA)). 1 Jul 1981. Contract FG06-79ET27256. 63p. NTIS, PC A04/MF A01. Order Number DE82015108.

Portions of document are illegible.

The findings of a feasibility study performed for Basin View Heating District in Klamath Falls, Oregon are reported. The purpose of the study is to determine the physical, economic, and political feasibility of establishing a geothermal heating district to provide space heat to housing units in the Basin View Development of Klamath Falls. Of the several systems considered, all are physically feasible. The project is politically feasible if the owner compiles with governmental requirements. Economic feasibility is based on considerations of money value rates, tax rates and expected rates of return, which are dependent on government and money markets. For analysis a money value rate of 21% and an owner's marginal tax rate of 35% were adopted.

56668 **(DOE/ET/27256—T21) Community heat-pump system, Klamath County, Oregon.** (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center). Mar 1982. Contract FG06-79ET27256. 19p. NTIS, PC A02/MF A01. Order Number DE82015106.

Portions of document are illegible.

The possibility of heating 47 proposed homes on a new development site using ground water source heat pumps is discussed. The Shield Crest tract is located approximately five miles southeast of downtown Klamath Falls, Oregon. Two moderate capacity (greater than 450 gpm) warm water wells are located on the property. The pumping temperatures are 78°F for No. 2 Well, neither temperature is hot enough for direct space heating. Temperature profiles of the wells indicate that a temperature hot enough for direct heating (about 110°F or above) cannot be found at reasonable depth. Since direct geothermal heating is not a practical alternative, the tract will be all-electric since this is the only energy source in the area. This study addresses the economic feasibility of a community heat pump system that would reduce the amount of electrical energy required to service the homes.

56669 **(DOE/ET/27256—T32) Geothermal potential for heating and cooling facilities, San Bernardino Valley College, San Bernardino, California.** Gemeinhardt, M.A.; Tharaldson, L.C. (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center; TMAD Engineers, Inc., Loma Linda, CA (USA)). Jul 1981. Contract FG06-79ET27256. 34p. NTIS, PC A03/MF A01. Order Number DE82015117.

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The potential for converting to geothermal heating at the campus of San Bernardino Valley College is considered. Also considered is the possibility of using well water for water cooled condenser cooling of air conditioning equipment. To provide water supply a production well, water distribution system and an injection well would be installed for each system.

56670 **(DOE/ET/27256—T34) Feasibility study for geothermal-water space heating for the Safford Federal Prison Camp, Safford, Arizona.** (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center; Johannessen and Girand Consulting Engineers, Inc., Tucson, AZ (USA)). Jul 1981. Contract FG06-79ET27256. 54p. NTIS (US Sales Only). Order Number DE82015132.

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The results of an economic feasibility study for the Oregon Institute of Technology regarding a geothermal heating system for the Federal Prison Camp, Safford, Arizona are presented. The following aspects were examined: heat load calculations of the buildings involved; mechanical equipment retrofits necessary to accept geothermal water for the purpose of space heating; cost estimates for the equipment retrofit; and evaluation of the equipment retrofit to determine economic feasibility.

56671 **(EGG-M—05481-C) Economics of geothermal direct-heat applications.** Hederman, W.F. Jr.; Cohen, L.A. (ICF, Inc., Washington, DC (USA)). Oct 1981. Contract AC07-80ID12099;AC07-76ID01570. 4p. (CONF-811015—22). NTIS, PC A02/MF A01. Order Number DE82005682.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

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Cost and production data from five commercial-scale geothermal direct-heat application projects are reviewed. Unit costs of geothermal energy under a variety of assumptions about production levels, costs, tax treatment, financial structure, and cost of capital are calculated and compared to prices of conventional fuels which would be displaced over the life of a geothermal project. Geothermal energy is found to be less costly than distillate fuel oil for all cases examined and cheaper than natural gas in many cases.

56672 **Non-electric utilization of geothermal resources.** Lund, J.W. (Oregon Inst. of Tech., Klamath Falls). *Geothermal Resources Council, Special Report;* No. 10, 53-56(May 1981). (CONF-810572—).

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

Direct utilization of geothermal energy has been used by many countries in the past on a small scale for bathing, cooking, and heating. Today, there are still many small-scale individual uses; however, many large-scale projects have been developed for district heating, greenhouse complexes, and industrial processing. The number of large-scale projects will continue to grow due to the escalation of fossil fuel costs and the proven technology of using insulated transmission lines and efficient heat exchangers for geothermal fluids. Today, over 3000 MW (thermal) of geothermal energy are used in direct applications, mainly in Iceland, New Zealand, USSR, Japan, and Hungary. In all cases, the cost of geothermal utilization is below that of comparable fossil fuel energy.

56673 **(PB—82-162090) Study of finned tube heat exchangers for air water media operating at low Reynolds numbers and applied to the design of low temperature convectors for domestic heating. Final report.** de Turckheim, N.; Roth, B. (Commission of the European Communities, Luxembourg). [nd]. 43p. (EUR—7026-FR). NTIS PC E03/MF E03.

A prototype air-water convector incorporating heat exchanger tubes with rectangular fins, has been developed. Studies have been carried out to optimize fin heights and spacings to give the best heat exchange configuration. Tests performed on the convector at room temperature demonstrated its ability to supply the thermal power required to heat a dwelling from a 55C geothermal water inlet temperature without any back-up heat pump, and to keep the water outlet temperature below 30C whatever the climatic conditions. Costs of mass production have been estimated and are considered to be competitive with other commercial convectors in the low temperature range. CECA-CEE-CEEA, Bruxelles-Luxembourg, 981.)

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 56634, 56657, 56658, 56659

56674 **(DOE/ID/12079—45) Summary of potassium/argon dating, 1981. Topical report.** Evans, S.H. Jr.; Brown, F.H. (Utah Univ., Salt Lake City (USA). Dept. of Geology and Geophysics). Sep 1981. Contract AC07-79ID12079. 32p. NTIS, PC A03/MF A01. Order Number DE82019905.

The analytical results for the last fiscal year effort in potassium/argon dating in support of US Department of Energy programs are summarized. Nearly 100 new dates have been generated. Recalibration of the argon extraction tables resulted in refinement of values for tracer ratios and depletion constants for our two extraction lines. Tracer ratios are (^{36}Ar/^{38}Ar)/sub T/ = 0.0308 and 0.0000449; (^{40}Ar/^{38}Ar)/sub T/ = 0.0501 and 0.0014 for extraction tables 1 and 2, respectively. Tracer depletion constants are -0.0002250 and -0.0005501 for tables 1 and 2, respectively. Initial values for the argon tracer pipettes are 3.2522 x 10^{-11} moles and 3.9329 x 10^{-11} moles for tables 1 and 2, respectively.

56675 **Equations and type curves for predicting the polymerization of amorphous silica in geothermal brines.** Weres, O.; Yee, A.; Tsao, L. (Lawrence Berkeley Lab, Calif, USA). *SPEJ, Society of Petroleum Engineers Journal;* **22**: No. 1, 9-16(Feb 1982).

The polymerization of dissolved silica in aqueous solutions up to 100/degree/C and containing up to 1 M NaCl has been studied experimentally and theoretically. In this study, the results of this work are presented in a form suitable for practical use in interpreting and predicting the chemistry of silica in geothermal brines. Empirical equations for calculating the rate of molecular deposition of silica on surfaces as a function of silica concentration, temperature, pH, and salinity are presented. Theoretically calculated type curves that depict the decrease of dissolved silica concentration by homogeneous nucleation and particle growth are presented, along with the procedures for using them to predict the course of this process under different conditions. 11 refs.

56676 **Round-robin evaluation of methods for analysis of geothermal brine.** Watson, J.C. (Battelle, Pac Northwest Lab, Richland, WA). *American Society for Testing and Materials, Special Technical Publication;* No. 717, 236-258(1980). (CONF-790283—; CONF-7904194—).

From Conference on geothermal scaling and corrosion; New Orleans, LA, USA (19 Feb 1979).

In 1976, Pacific Nortwest Laboratory initiated a program to determine the state of the art of methods of analysis for geothermal fluids. A meeting between government agencies and laboratories led to agreement on 40 parameters for evaluation in a round-robin field testing program. Two round-robins were conducted with approximately 20 laboratories participating in the analysis. Statistical analysis of the data from these tests shows that the greatest range of results was obtained for the species silver, aluminum, antimony, fluoride, bromide, iodine, phosphate and total hydrogen sulfide. In addition, the constituents rubidium, coper, managanese, lead, and zinc showed a high degree of variability for the brine with low total dissolved solids. 19 refs.

16 TIDAL POWER

1607 Tidal Power Plants

56677 **(AD-A—110129/4) Global ocean tides. Part VIII. The semidiurnal luni-solar declination tide (K2), atlas of tidal charts and maps. Final report.** Schwiderski, E.W. (Naval Surface Weapons Center, Dahlgren, VA (USA)). Jun 1981. 91p. NTIS, PC A05/MF A01.

In Part I (Schwiderski, 1978a) of this report, a unique hydrodynamical interpolation technique was introduced, extensively tested, and evaluated in order to compute partial global ocean tides in great detail and with a high degree of accuracy. This novel method has been applied to construct the semidiurnal luni-solar declination (K2) ocean tide with a relative accuracy of better than 5 cm anywhere in the open oceans. The resulting tidal amplitudes and phases are tabulated on a 1 x 1 deg grid system in an atlas of 42 x 71 deg overlapping charts covering the whole oceanic globe. A corresponding atlas of global corange and cotidal maps is included to provide the reader with a quick general overview of the major tidal phenomena. The specifying hydrodynamical parameters of the model are listed along with quoted sources of empirical tide data, and significant tidal features are explained and discussed. As expected, since the periods of the semidiurnal K2 (11.97 h) and S2 (12.00 h) tides differ by only 0.03 h, these two tides are almost copies of each other (compare Part III). Some differences occur only in areas with rapid tidal variations.

1608 Wave Energy Converters

56678 **(AD-A—109832/6) Surface wave statistics and spectra during high sea state conditions in the North Atlantic. Memorandum report.** McClain, C.R.; Chen, D.T.; Hart, W.D. (Naval Research Lab., Washington, DC (USA)). 30 Dec 1981. 33p. (NRL-MR—4722). NTIS, PC A03/MF A01.

Surface wave data collected using an airborne laser profilometer during high sea state conditions are analyzed to produce statistical cumulants up to the fifth order and power spectra. Theoretically, the third cumulant, skewness, is directly proportional to the wind-wave significant slope. This relationship is supported by wind-wave tank data, but little field data of this kind is available in the literature. Also, it has been suggested that if skewness can be derived from radar altimeter data, the significant slope would be computed and together with another altimeter product, the rms wave height, the wave spectra can be estimated using the Wallops Spectral Model (WSM). The results of this study indicate that the skewness relationship is valid for wind-wave dominated seas but as the swell contribution to rms wave height increases, the combined wave field skewness monotonically decreases below the predicted value. The WSM yields excellent reproductions of the wind-wave spectra even in multiple-peaked seas providing that the model inputs are properly determined for the wind-wave subfield. Finally the altimeter-WSM scheme should work reasonably well when the seas are wind-wave dominated provided that the altimeter can accurately measure skewness. More research on intermediate and swell dominated conditions is recommended.

17 WIND ENERGY

56679 **(SERI/PR—211-1672) Wind-energy program: FY 1982 third quarterly review.** Mitchell, R.; Noun, R.J.; Flaim, T.; Deutsch, M.; Hock, S.; Sklar, H.; Kelley, N.D. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1982. Contract AC02-77CH00178. 33p. NTIS, PC A03/MF A01. Order Number DE82019928.

The objective, accomplishments, planned activities, output, and subcontracts are briefly summarized for each of the following tasks of the Wind Energy Program: program management and planning, wind energy conversion systems (WECS) application in nongenerating utilities, technical feasibility of stand-alone small WECS (SWECS), WECS performance/value analysis, wind energy industry analysis, wind systems coordination, wind workshops, noise and television interference studies, and advanced and innovative wind energy concepts. Each task summary includes a milestone chart. Also given are lists of research and development subcontracted projects for FY 1981 and FY 1982, principal subcontractors for FY 1982 projects, and current Wind Energy Program publications. (LEW)

1701 Availability (climatology)

56680 (MASEC-CF—81-096, pp 158-176) **Wind energy.** Riaz, M. (Univ. of Minnesota, Minneapolis). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

An overview is presented of small (< 100 kW) wind energy electrical conversion systems. A block diagram of the total system, wind electric conversion efficiencies, wind speed-time distributions, wind power-time distributions are treated as well as the economics of a 15 kWh system including cost, upkeep, tax credit, etc. ($0.19/kWh). The current status is summarized as: (1) technology is ready; (2) approaches are varied and multiple; (3) environmental impact is modest; (4) energy and capacity displacement are capable; and (4) systems may be cost competitive for specific situations. Calculations are presented for wind power and for wind distribution. The various electrical generation models (constant frequency, variable frequency, ac or dc etc) are considered as well as economic models. Utility interface issues (economic, operational, technical, and environmental) are mentioned and it is concluded that more data, tests, and experience are needed. (MJJ)

56681 **(SERI/TR—215-1612) Boundary-layer mesoscale wind analysis.** Mikhail, A. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1982. Contract AC02-77CH00178. 24p. NTIS, PC A02/MF A01. Order Number DE82020414.

Described is a wind mesoscale data network formed by data collected from the Prototype Regional Observing Forecasting (PROFS) network, established by the National Oceanic and Atmospheric Administration (NOAA). The data network includes other sources as well, such as the National Climatic Center (NCC) and the NOAA meteorological tower in Erie, Colorado. A methodology for analyzing the mesoscale variability of the wind resource is suggested. The analysis is based on mesoscale parameters that influence the transfer of momentum in the surface layer. The parameters discussed are site elevation, distance from the coast, angular horizon, surface roughness length, thermal stability, shape, and geostrophic wind. Various methods of evaluating these parameters have been detailed. The contribution of the parameters to mesoscale wind variability is analyzed.

1704 Economics

REFER ALSO TO CITATION(S) 56680, 57130

56682 (PNL—3962) Analysis of the effects of integrating wind turbines into a conventional utility: a case study. Final report. Goldenblatt, M.K.; Wegley, H.L.; Miller, A.H. (Pacific Northwest Lab., Richland, WA (USA); JBF Scientific Corp., Wilmington, MA (USA)). Aug 1982. Contract AC06-76RL01830. 66p. NTIS, PC A04/MF A01. Order Number DE82020254.

The impact on a utility incorporating wind turbine generation due to wind speed sampling frequency, wind turbine performance model, and wind speed forecasting accuracy is examined. The utility analyzed in the study was the Los Angeles Department of Water and Power and the wind turbine assumed was the MOD-2. The sensitivity of the economic value of wind turbine generation to wind speed sampling frequency and wind turbine modeling technique is examined as well as the impact of wind forecasting accuracy on utility operation and production costs. Wind speed data from San Gorgonio Pass, California during 1979 are used to estimate wind turbine performance using four different simulation methods. (LEW)

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 56589, 56680, 57050

56683 Procedures for modeling wind turbine performance from site wind data. Pennell, W.T.; Miller, A.H. (Battelle, Pac Northwest Lab, Richland, WA). *American Society of Mechanical Engineers, [Paper];* No. 82-Pet-7, vp([nd]).

A key problem in wind turbine siting is estimating how a given wind turbine will perform at a given site. Solving this problem requires a model for converting wind information from a site into accurate simulations of how a wind turbine installed at that site would have performed. This paper reviews current procedures for modeling wind turbine energy production and discusses the strengths and weaknesses of each procedure. 11 refs.

56684 (AD-A—110337/3) Wind power utilization guide. Report for Jul 75-Sep 80. Pal, D. (Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)). Sep 1981. 218p. (CEL-TN—1613). NTIS, PC A10/MF A01.

This report presents general information covering site wind potential and characteristics, specific design, system design, and siting requirements for utilization of wind energy conversion systems (WECS) at Navy installations. The objective of this report is also to provide a method for performing economic analysis to plan and justify a WECS in a particular Navy application. The information presented here is sufficient to enable an engineer to prepare a system's design to conduct a feasibility study for a given application of WECS. Most Navy applications of wind power will involve generation of electricity using small wind turbine generators (less than 60 kW size), with or without storage, located at remote Navy sites. Larger (over 100 kW size) WECS will, generally, be integrated with a base grid located on remote overseas or CONUS bases. This report, however, deals only with guidance for applying small WECS at Navy installations. The subject matter is divided into five parts dealing respectively with wind behavior and its determination with wind-driven turbines, power conditioning requirements, siting requirements, and the economics of wind power under different conditions. Three examples are given to demonstrate use of these sections in developing the required feasibility or design information for a given application.

56685 (DOE/ET/23164—1) Wind energy: data acquisition and real-time analysis. Dastmalchi, B. (Colorado State Univ., Fort Collins (USA). Dept. of Mechanical Engineering). Dec 1980. Contract AC06-79ET23164. 134p. NTIS, PC A07/MF A01. Order Number DE82020040.

Portions of document are illegible.

A minicomputer-based data acquisition system was developed that supplies a curve fit of data in real time and is small enough to be easily carried and installed as a portable unit. The algorithm for data analysis was developed and the software provided for a Hewlett Packard HP9845T minicomputer. The algorithm was then tested on a Darrieus wind turbine generator located at the Colorado State University dairy farm. The measurements include: wind speed and direction, air temperature, and ac power for each phase of the three-phase induction generator. A linear model is described for the power vs. wind speed curve, and the effect of wind variation (gustiness) is considered. Software for the system is listed and discussed. Results are then presented and compared. (LEW)

56686 (DOE/R5/10301—1-Final) Development of a slide program describing a site-selection process for small wind-energy-conversion systems (SWECS). Final technical report. Otawa, T. (Otawa (Toru), Muncie, IN (USA)). May 1982. Contract FG02-81R510301. 79p. NTIS, PC A05/MF A01. Order Number DE82017394.

A slide program has been developed primarily to promote a proper site-selection method for small wind energy conversion systems (SWECS). This report covers the technical background of the program development. The objectives of this project are four-fold: (1) to clarify a variety of factors affecting the SWECS siting process, (2) to investigate in detail the effectiveness of existing SWECS siting techniques, (3) to translate the factors into criteria for site-selection, and (4) to clearly present a prototype site-screening procedure for SWECS. The intent of this development is not to identify a specific site in a geographic area suitable for SWECS installation but to summarize and present rules of thumb for SWECS siting as well as the major findings of scientific and technical siting studies conducted in the past. The major issues involved in SWECS siting are: wind-resource assessment techniques, land-use constraints, potential hazards, potential environmental impact, site accessibility and proximity to load location. These factors are incorporated into a method of site-screening to maximize energy output as well as to discourage the negative impact of SWECS siting on the environment. The method utilizes the technique of overlay mapping to analyze different relationships among various patterns of land characteristics. Transparent or semi-transparent maps depicting the patterns are overlaid to show a pattern of light and dark tones revealing areas of site potentials and limitations for SWECS placement. A case-study is conducted to demonstrate the site-selection method developed in this study.

56687 (DOE/R5/10309—1) WECS-Load controlled pitch-variable load conversion to heat. (Secord (Nelson W.), Brighton, MI (USA)). 29 Mar 1982. Contract FG02-81R510309. 5p. NTIS, PC A02/MF A01. Order Number DE82014683.

The planned work described consists of installing a 4 kW windmill and instrumentation on a 100-ft. free-standing lattice tower, developing load control circuitry that will store excess energy in a 1000-gallon electrically heated water tank which will also heat domestic via a heat exchanger, and developing a torque controlled pitching hub and blade system. Project status and costs are discussed. (LEW)

56688 (PB—82-161985) Aerodynamic studies of a straight-bladed vertical-axis wind turbine. Bannister, W.S. (Napier Coll. of Commerce and Technology, Edinburgh (UK). Dept. of Mechanical Engineering). Apr 1979. 52p. NTIS, PC A04/MF A01.

A straight bladed vertical axis wind turbine has been constructed at Napier College. The turbine has a diameter of 3 m and vertical blades 2 m in length. The installation has been constructed as a test bed in order to test various blade configurations. A theoretical study, using the Musgrove type of analysis, has been completed on a design which incorporates a number of horizontal streamlined cross-arms connected to vertical blades. The analysis has included the drag of the cross-arms, the effect of operation at low Reynolds Number and the effect of induced drag. The resulting design of turbine is simple, robust and capable of operating with high efficiency at high wind velocities. A relatively high annual energy output is obtainable with a load characteristic giving torque proportional to the square of the rotational speed. The test installation will be used to determine the characteristics of various turbine configurations and results will subsequently be compared with theoretical predictions.

56689 (PNL—4283) Candidate wind-turbine-generator site: annual data summary, January 1981-December 1981. Sandusky, W.F.; Buck, J.W.; Renne, D.S.; Hadley, D.L.; Abbey, O.B. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 298p. NTIS, PC A13/MF A01. Order Number DE82020416.

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Summarized hourly meteorological data for 34 candidate and wind turbine generator sites for calendar year 1981 are presented. These data are collected for the purpose of evaluating the wind energy potential at these sites and are used to assist in selection of potential sites for installation and testing of large wind turbines in electric utility systems. For each site, wind speed, direction, and distribution data are given in eight tables. Use of information from these tables, with information about specific wind turbines, should allow the user to estimate the potential for wind energy production at each site.

56690 (RFP—3302/2-Vol.2) Kaman 40-kW wind system. Phase II. Fabrication and tests. Volume II. Technical report. Howes, H.; Perley, R. (Kaman Aerospace Corp., Bloomfield, CT (USA)). Jan 1981. Contract AC04-76DP03533. 166p. NTIS, PC A08/MF A01. Order Number DE82015146.

A program is underway to design, fabricate and test a horizontal axis Wind Turbine Generator (WTG) capable of producing 40 kW electrical output power in a 20 mph wind. Results are presented of the program effort covering fabrication and testing of the Wing Turbine Generator designed earlier. A minimum of difficulties were experienced during fabrication and, after successful completion of Contractor tests through 20 mph winds, the WTG was shipped to Rocky Flats, assembled and operated there. The 40 kW WTG is presently undergoing extended tests at Rockwell's Rocky Flats test facility.

56691 (RFP—3304) McDonnell 40-kW Giromill Wind System. Phase II. Fabrication and test. Brulle, R. (McDonnell Aircraft Co., St. Louis, MO (USA)). Jun 1980. Contract AC04-76DP03533. 69p. NTIS, PC A04/MF A01. Order Number DE82015145.

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A 40 kW vertical axis windmill called a "Giromill" was fabricated, erected, and tested. The system design is described as well as some design changes made during fabrication. Manufacturing cost estimates are updated. Fabrication of the turbine blades, support arms, and fixed and rotating tower is described as well as the tests. Testing included control systems acceptance tests; Giromill system acceptance tests; structural, mechanical, control system and electric generation operational tests; and performance tests connected to the utility grid. (LEW)

56692 (RFP—3310/2) North Wind Power Company 2-kilowatt high-reliability wind system. Phase I. Design and analysis. Technical report. Mayer, D.J.; Norton, J.H. Jr. (North Wind Power Co., Warren, VT (USA)). Jul 1981. Contract AC04-76DP03533. 168p. NTIS, PC A08/MF A01. Order Number DE82015124.

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Results are presented of Phase I of a program to design a 2kW high reliability wind turbine for use in remote locations and harsh environments. In phase I of the program, a predecessor of the proposed design was procured and tested in a wind tunnel and in the freestream to observe operational characteristics. An analytical procedure was developed for designing and modelling the proposed variable axis rotor control system (VARCS). This was then verified by extensive mobile testing of pre-prototype components. A low speed three phase alternator with a Lundel type rotor was designed. Prototypes were fabricated and tested to refine calculation procedures and develop an effective alternator with appropriate characteristics. A solid state field switching regulator was designed and tested successfully. All necessary support elements were designed and engineered. A complete analysis of system reliability was conducted including failure mode and effects analyses and reliability, maintenance and safety analyses. Cost estimates were performed for a mature product in production rates of 1000 per year. Analysis and testing conducted throughout the first phase is included.

56693 (SAND—82-0672) Aeroelastic stability analysis of a Darrieus wind turbine. Popelka, D. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1982. Contract AC04-76DP00789. 37p. NTIS, PC A03/MF A01. Order Number DE82017001.

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An aeroelastic stability analysis has been developed for predicting flutter instabilities on vertical axis wind turbines. The analytical model and mathematical formulation of the problem are described as well as the physical mechanism that creates flutter in Darrieus turbines. Theoretical results are compared with measured experimental data from flutter tests of the Sandia 2 Meter turbine. Based on this comparison, the analysis appears to be an adequate design evaluation tool.

56694 (SERI/TR—09172-2) Technical and economical assessment on tethered wind-energy systems (TWES). Furuya, O.; Maekawa, S. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1982. Contract AC02-77CH00178. 88p. NTIS, PC A05/MF A01. Order Number DE82017120.

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The objective of the work reported was to establish the potential of tethered wind energy systems for energy conversion in the upper atmosphere. Of the concepts investigated, the Vertical Takeoff and Landing (VTOL) lift generation concept had the highest potential as compared to balloon, wind and hybrid concepts.

56695 (SERI/TR—11052-1) Investigations of the tornado wind energy system. Yen, J.T. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1982. Contract AC02-77CH00178. 146p. NTIS, PC A07/MF A01. Order Number DE82017122.

Current test results are presented on the Tornado Wind Energy System (TWES). The objective of the study was to determine the performance and potential of TWES systems using wind tunnel models. Experimental results on system performance with a simple bladed turbine in both the Grumman Research Tunnel and Langley V/STOL Tunnel are presented, followed by descriptions of a larger, 15-ft model and data from tests of a 30-in turbine, as well as results from a cost analysis. It is concluded that TWES has a good commercial potential.

56696 Wind shear and gustiness at the Mod-1 site, Boone, North Carolina. Garstang, M.; Snow, J.W.; Emmitt, G.D. (Univ of Va, Charlottesville). *Journal of Energy;* **5**: No. 3, 146-151(May-Jun 1981).

The purpose of this paper is to show to what extent, in the presence of the fairly marked topography of the Boone site, the vertical shear of horizontal wind is a function of wind speed, wind direction, and the static stability of the atmosphere close to the ground. It further verifies that the levels of turbulence are considerably higher in the region of shear than in the more uniform current above the shearing layer.

56697 Small wind systems - an update. Trenka, A.R.; Dodge, D.M. (Rockwell Int, USA). *Mineral and Energy Resources;* **24**: No. 3, 1-8(May 1981).

Described are the status and achievements of a program to develop reliable, safe, and economical small (under 1000 kW) wind machines. Specifications are given for prototype designs which are fabricated and tested under this program. The research and technology projects planned for the fiscal year 1982 are discussed and some trends in the future development of the state-of-the-art outlined.

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56698 (AD-A—110551/9) Sensitivity and parametric bound analysis of an electric power generation gp model: optimal steam turbine exhaust annulus and condenser sizes. Scientific report. Fiacco, A.V.; Ghaemi, A. (George Washington Univ., Washington, DC (USA). Program in Logistics). 1 Aug 1981. 40p. (SERIAL-T—437). NTIS, PC A03/MF A01.

As a further demonstration of practical applicability, a polynomial programming model for the optimal selection of steam turbine exhaust annulus and condenser sizes developed by Ecker and Wiebking is solved and analyzed for optimal value function sensitivities and parametric optimal value bounds. This provides the essential information for conducting a thorough cost benefit analysis over the large parameter changes considered, for this extremely important class of energy applications.

56699 (BARC—1110) Deposit control in process-cooling-water systems. Venkataramani, B. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 43p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82903349.

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In order to achieve efficient heat transfer in cooling water systems, it is essential to control the fouling of heat exchanger surfaces. Solubilities of scale-forming salts, their growth into crystals, and the nature of the surfaces play important role in the deposition phenomenon. Condensed phosphates, organic polymers and compounds like phosphonates are effective in controlling deposition of scale forming salts. The surface active agents inhibit crystal growth and modify the crystals of the scale forming salts, and thus prevent deposition of dense, uniformly structured cryrstalline mass on the heat transfer surface. Understanding the mechanism of biofouling is essential to control it by surface active agents. Certain measures taken in the plant, such as back flushing, to control scaling, sometimes may not be effective and can be detrimental to the system itself.

56700 (CISE—1724) Data bank of in situ tests performed on the condenser cooling circuits of La Casella thermal power plant (piacenza, italy). Daco, E.; Meregelli, E. (Centro Informazioni Studi Esperienze, Milan (Italy)). 1981. 20p. (CONF-8109169—). NTIS, PC A02/MF A01.

From 5. international symposium on water column separation; Obernach, F.R. Germany (28 Sep 1981).

The data bank formed by the digitized oscillograms relevant to quantities measured during an experimental test program is described. The experimental program was to test a condenser cooling plant and investigate hydraulic phenomena occurring in the plant as a consequence of startup, pump stop, or pump trip-off operations. The computer program for data bank management is explained. The organization of the magnetic tape on which the data bank and management program are stored is also covered. The management program listing and an example of program use are provided. (ESA)

56701 (DOE/ET/10340—132) High-temperature turbine technology program hot-gas path development test. Part II. Testing. Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Mar 1982. Contract AC01-76ET10340. 189p. NTIS, PC A08/MF A01. Order Number DE82014462.

This topical report of the US Department of Energy High-Temperature Turbine Technology (DOE-HTTT) Phase II program presents the results of testing full-scale water-cooled first-stage and second-stage turbine nozzles at design temperature and pressure to verify that the designs are adequate for operation in a full-scale turbine environment. Low-cycle fatigue life of the nozzles was demonstrated by subjecting cascade assemblies to several hundred simulated startup/shutdown turbine cycles. This testing was accomplished in the Hot-Gas Path Development Test Stand (HGPDTS), which is capable of evaluating full-scale combustion and turbine nozzle components. A three-throat cascade of the first-stage turbine nozzle was successfully tested at a nozzle inlet gas temperature of 2630°F and a nozzle inlet pressure of 11.3 atmospheres. In addition to steady-state operation at the design firing temperature, the nozzle cascade was exposed to a simulated startup/shutdown turbine cycle by varying the firing temperature. A total of 42 h at the design point and 617 thermal cycles were accumulated during the test periods. First-stage nozzle test results show that measured metal and coolant temperatures correspond well to the predicted design values. This nozzle design has been shown to be fully satisfactory for the application (2600°F), with growth capability to 3000°F firing temperature. A post-test metallurgical examination of sectioned portions of the tested nozzles shows a totally bonded structure, confirming the test results and attesting to the successful performance of water-cooled composite nozzle hardware.

56702 (DOE/ET/10340—134) Development of high-temperature turbine subsystem technology to a technology readiness status Phase II. Quarterly report, January-March 1982. Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Apr 1982. Contract AC01-76ET10340. 46p. NTIS, PC A03/MF A01. Order Number DE82014587.

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The objective of the DOE-HTTT (High-Temperature Turbine Technology) Program is to bring to Technology Readiness, over a six- to ten-year duration, a high-temperature gas turbine for use in a combined-cycle power plant, with coal-derived fuel at a firing temperature of 2600°F and with growth capability to 3000°F. Phase II, Technology Testing and Test Support Studies, commenced on August 1, 1977, with its objectives to: perform component design and technology testing in critical areas; perform system design and trade-off analyses in sufficient depth to support the component design and test tasks; and update the Phase I combined-cycle plant studies to evaluate the commercial validity of a GE-TRV gas turbine system. During this reporting period the major effort was on motorized rig tests to acquire the heat transfer data needed to design the cooling passages within the rotating components of the TRV gas turbine. A single specimen was tested extensively during the reporting period. The tested specimen, with a 0.083-inch-diameter passage STEM-drilled in an IN718 tube, is prototypical of eight cooling passages in the Stage 1 bucket and all cooling passages in Stages 2 and 3. The performance of this specimen was better than the performances of all smooth specimens tested previously, both in terms of power at boiling transition and in terms of wetted area. These favorable results hve been used to review the cooling flows and the need for turbulence promoters in TRV buckets.

56703 (EPRI-AP—2487) Cool water coal gasification program. First annual progress report. Interim report. (Bechtel Power Corp., Houston, TX (USA); General Electric Co., Schenectady, NY (USA); Southern California Edison Co., Rosemead (USA); Texaco, Inc., White Plains, NY (USA)). Jul 1982. 171p. NTIS, PC A08/MF A01. Order Number DE82905831.

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This report presents current status information on the Cool Water Coal Gasification Program, a private industry jointly funded effort to design, build, and operate a 100 MW coal-based power plant to demonstrate new integrated gasification combied cycle (IGCC) technology at a commercial scale. Background on the project is provided and the organizational structure is discussed. Planned facilities are described quite extensively, and a number of relevant drawings are included. Design issues are identified and plant operating and control requirements are addressed. The expected plant performance is indicated for normal and special test conditions. The project cost estimate and present funding support are briefly summarized. The progress of the engineering work and the overall project status are reported. The regulatory process and permit history are reviewed. Plans regarding plant testing, as currently defined, are also discussed. As the Cool Water effort proceeds, EPRI intends to publish annual reports updating the project progress.

56704 **(EPRI-AP—2495) Investigation of combined-cycle steam-plant problems. Final report.** Crutchfield, H.C. (Crutchfield (H.C.), Salt Lake City, UT (USA); COE Corp., Mountain View, CA (USA)). Jul 1982. 20p. NTIS, PC A02/MF A01. Order Number DE82905813.

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The operation and maintenance of gas turbine combined-cycle steam generators is reviewed. Feedwater cycles and auxiliary equipment are also discussed, and the results of on-site discussions with operating and maintenance personnel are presented. Actual problems encountered are delineated, and recommendations are given for improving operation of existing plants, for design of new plants, and for future research and development.

56705 **(EPRI-CS—2275) Preliminary assessment of alternative atmospheric fluidized-bed-combustion power-plant systems. Final report.** Bianchini, J.; Rogali, R.; Wysocki, J.; Bradley, W. (Burns and Roe, Inc., Woodbury, NY (USA)). Feb 1982. 270p. NTIS (US Sales Only). Order Number DE82903278.

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This report presents a technical and economic evaluation of alternative atmospheric fluidized-bed combustion (AFBC) power plant systems with nominal capacities of 1000 MWe. Both eastern and western coal-fired power plants are evaluated for the following systems: baseline AFBC power plants with limestone beds; AFBC power plants with inert beds and wet FGC systems; AFBC power plant with inert beds and a dry FGD system (western coal only); AFBC power plants with limestone beds and limestone precalcination; AFBC power plants with limestone beds and agglomeration and recycle of spent solids; AFBC power plant with limestone beds and sorbent regeneration (eastern coal only); and reference pulverized coal-fired (PCF) power plants with wet FGC systems. The eastern coal-fired plants burn Illinois bituminous coal with a higher heating value of 10,1000 Btu/lb and a sulfur content of 4%. The western coal-fired plants burn Wyoming subbituminous coal with a higher heating value of 8020 Btu/lb and a sulfur content of 0.48%. The capital and operating cost estimates are based on boiler designs developed by Babcock and Wilcox, Inc., and on sorbent requirements estimated by Westinghouse R and D Center. Sorbent requirements for the baseline AFBC power plants are based on a calcium to sulfur mole ratio of 5:1 for the eastern coal-fired plant and 0.7:1 for the western coal-fired plant. The Ca/S mole ratio for the western coal plant allows for 30 percent utilization of the alkaline coal ash to reduce sorbent requirements to the fluidized bed combustor. The economic analyses are based on a plant located in the East Central region of the United States with a 30-year life and a 70 percent capacity factor.

56706 **(EPRI-CS—2367) Acoustic-emission monitoring of steam turbines. Final report.** Graham, L.J.; Randall, R.L.; Hong, C. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group; Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Apr 1982. 115p. NTIS, PC A06/MF A01. Order Number DE82904663.

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The objective of this project was to develop a method for the on-line detection of crack growth in steam turbine rotors based on acoutic emission (AE) monitoring. This required a considerable extension of conventional techniques because of the high levels of background noise and the inaccessibility of the rotor for optimum transducer placement. A systematic study involving a number of tasks was performed to evaluate the potential for the detection and correct identification of crack growth AE signals during various turbine operating conditions. These included acoustic wave propagation and attenuation measurements, backgrouns noise characterization, laboratory rotor material tests, monitoring equipment optimization, dynamic stress analysis of the rotor under transient operation and on-line source location and signal characterization. No crack growth was detected during the monitoring periods but there was sufficient information from the combined tasks to estimate the flaw growth detectability during different operating conditions if it occurs. The experience also suggests that AE monitoring can be useful for diagnosis of other turbine problems such as blade rubbing, out-of-balance condition, bearing deterioration, lubricating oil contamination and perhaps boiler exfoliation and blade erosion.

56707 **(EPRI-EL—2519-Vol.1) Modeling of unit operating considerations in generating-capacity reliability evaluation. Volume 1. Mathematical models, computing methods, and results. Final report.** Patton, A.D.; Ayoub, A.K.; Singh, C.; Hogg, G.L.; Foster, J.W. (Associated Power Analysts, Inc., Bryan, TX (USA)). Jul 1982. 246p. NTIS, PC A11/MF A01. Order Number DE82905828.

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Existing methods for generating capacity reliability evaluation do not explicitly recognize a number of operating considerations which may have important effects in system reliability performance. Thus, current methods may yield estimates of system reliability which differ appreciably from actual observed reliability. Further, current methods offer no means of accurately studying or evaluating alternatives which may differ in one or more operating considerations. Operating considerations which are considered to be important in generating capacity reliability evaluation include: unit duty cycles as influenced by load cycle shape, reliability performance of other units, unit commitment policy, and operating reserve policy; unit start-up failures distinct from unit running failures; unit start-up times; and unit outage postponability and the management of postponable outages. A detailed Monte Carlo simulation computer model called GENESIS and two analytical models called OPCON and OPPLAN have been developed which are capable of incorporating the effects of many operating considerations including those noted above. These computer models have been used to study a variety of actual and synthetic systems and are available from EPRI. The new models are shown to produce system reliability indices which differ appreciably from index values computed using traditional models which do not recognize operating considerations.

56708 **(EPRI-EL—2519-Vol.2) Modeling of unit operating considerations in generating-capacity reliability evaluation. Volume 2. Computer-program documentation. Final report.** Patton, A.D.; Ayoub, A.K.; Singh, C.; Hogg, G.L. (Associated Power Analysts, Inc., Bryan, TX (USA)). Jul 1982. 129p. NTIS, PC A07/MF A01. Order Number DE82906446.

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This report describes the structure and operation of prototype computer programs developed for a Monte Carlo simulation model, GENESIS, and for two analytical models, OPCON and OPPLAN. It includes input data requirements and sample test cases.

56709 **(EUR—7529-DE) Evaluation of attainable efficiencies and costs for generation of electricity from hydrogen.** Sternfeld, H.J.; Wojkowsky, H.; Schnurnberger, W. (Commission of the European Communities, Luxembourg). 1981. 233p. Commission of the European Communities, Luxembourg.

For the generation of electricity from stored hydrogen, H_2/O_2- and H_2/air fuel cells as well as gas turbines and steam turbine cycles can be applied within a measurable space of time. In this study, alternative methods are technically and economically evaluated. All important parameters effecting the energy conversion efficiencies are taken into account. Power levels of 25, 50 and 100 megawatts, which are preferably used for peak-power plants, are considered for annual operating times between 500 and 3000 hours. The highest overall efficiencies of more than 50% are offered by the H_2/O_2-steam turbine process and the H_2/O_2-fuel cell, while a simple gas turbine power plant yields close to 30%, the lowest value found. The cost of electricity decreases with increasing power level and annual operating time. The lowest values are found for a 100 MW-hydrogen/oxygen steam turbine power plant; while for the 25 MW-power level and a very short annual operating time, the H_2/O_2-fuel cell system offers slightly lower cost values than the H_2/O_2-steam turbine plant. Peak power electricity from hydrogen, however, could be produced at a cost level almost comparable with existing devices, when a fossil fired base-load power plant is equipped with a supplementary H_2/O_2-steam generator that complements the varying power demands.

56710 **(GAT-S—24/Rev.1) Corrosion in coal-fired boilers.** Vausher, A.L. (Goodyear Atomic Corp., Piketon, OH (USA)). 1982. Contract AC05-76OR00001. 17p. (CONF-820418—7Rev.1). NTIS, PC A02/MF A01. Order Number DE82014824.

From UCC-ND and GAT environmental protection seminar; Gatlinburg, TN, USA (5 Apr 1982).

The corrosive effect of the flue gas and the fly ash from burning coal on combustion and pollution control equipment has led to extensive research efforts aimed at solving this problem. A wide variety of chemical additives are offered by suppliers to perform corrosion reduction functions when added to the solid or liquid fuel. Protection of equipment by the use of corrosion resistant coatings and improved designs to prevent or reduce slag formation are also well known corrosion reduction techniques. However, the problem facing management is to evaluated the many different alternatives and to define the most effective one for their particular facility. Information gained from previous corrosion reduction attempts, and knowledge of factors which increase the SO_3/SO_2 ratio in the flue gas have resulted in the investigation of methods of controlling the dew point and therefore, reducing the condensation of sulfuric acid. Various methods of avoiding the formation of acid are being evaluated.

56711 (INIS-mf—7092, pp vp) **Utilization of nuclear energy as the source of district and process heat.** Curin, K. (Energoprojekt, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

Waste heat from nuclear power plants built in Czechoslovakia after 1980 will be used for district heating and for the heating of agricultural and industrial buildings. Waste heat from nuclear power plants may be used for increasing agricultural production. Hot water will be the coolant which will make it possible to attain a more efficient use of the heat cycle of nuclear power plants. Work is proceeding on a type study project of nuclear heat and power plants and the project is being studied of a nuclear heating plant.

56712 **(NASA-CR—165614) Low NO/sub x/ heavy fuel combustor concept program. Phase 1A: combustion technology generation coal gas fuels. Final report.** Sherlock, T.P. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Feb 1982. 57p. (DOE/NASA—0146-2). NTIS, PC A04/MF A01.

Combustion tests of two scaled burners using actual coal gas from a 25 ton/day fluidized bed coal gasifier are described. The two combustor configurations studied were a ceramic lined, staged rich/lean burner and an integral, all metal multiannual swirl burner (MASB). The tests were conducted over a range of temperature and pressures representative of current industrial combustion turbine inlet conditions. Tests on the rich lean burner were conducted at three levels of product gas heating values: 104, 197 and 254 btu/scf. Corresponding levels of NO/sub x/ emissions were 5, 20 and 70 ppmv. Nitrogen was added to the fuel in the form of ammonia, and conversion efficiencies of fuel nitrogen to NO/sub x/ were on the order of 4 percent to 12 percent, which is somewhat lower than the 14 percent to 18 percent conversion efficiency when SRC-2 liquid fuel was used. The MASB was tested only on medium btu gas (220 to 270 btu/scf), and produced approximately 80 ppmv NO/sub x/ at rated engine conditions. Both burners operated similarly on actual coal gas and erbs fuel, and all heating values tested can be successfully burned in current machines.

56713 **(NUREG—0873) Bayesian analysis of diesel generator failure data. Technical report.** Vesely, W.E.; Niyogi, P.K.; Goldberg, F.F.; Weldon, P.A. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jan 1982. 57p. NTIS, PC A04/MF A01.

A simple Bayesian approach has been developed to evaluate failure rate implications from the number of failures and number of successes in a given number of Diesel tests. For the Bayesian approach, the Diesel is modeled as having a constant, but unknown, probability of failure per trial whose possible values are describable by a probability distribution. The approach utilizes discrete probability distributions (probability mass functions) for ease of implementation. As a potential tool for the analyst, a computer code has been written to efficiently calculate the failure rate for any input test data and assumed prior distribution. The code can be used to monitor diesel tests for up-to-date failure rate implications. In addition, a wide variety of sensitivity analysis can be performed using the code.

56714 **(PB—82-163668) Water resources reference base for the 13a assessment of the texas portions of the texas gulf region and the red river basin. Technical memo.** (Camp Dresser and McKee, Inc., Austin, TX (USA)). Aug 1981. 172p. NTIS, PC A08/MF A01.

This report has been prepared as an interim product of the 13a water assessment study being conducted for a major portion of the State of Texas. The assessment includes water resource conditions, water availability, and water utilization for the Texas Gulf Region. Projected and current water use for electric power production are also given in the report.

56715 **Water demand for generating electricity: a mathematical programming approach with application in Poland.** Stone, J.C.; Singleton, F.D. Jr.; Gadkowski, M.; Salewicz, A.; Sikorski, W. Laxenburg, Austria; International Institute for Applied Systems Analysis (1982). 63p. (IIASA-RR—82-16). International Inst. for Applied Systems Analysis, A-2361, Laxenburg, Austria.

The findings of an analysis of water demands for a 3000-megawatt coal-fired power plant on the Vistula River in Poland are reported. This study considered the impacts of alternative resource prices and environmental standards on water demand with the aid of a mathematical programming model developed jointly by IIASA, the Industry Studies Program at the University of Houston (Houston, Texas, USA), and the Institute of Meteorology and Water Management (Warsaw, Poland). The model encompasses the power plant and its environment, as well as several related activities: coal transportation, coal beneficiation, and the evacuation of saline water emerging from the mining operations. While the application is quite specific, the approach is inherently general and can be followed in other geographical and economic contexts.

56716 **(PB—82-162900) An instrumental acoustic system for early diagnosis of the rupture of tube systems.** Azzoni, A.; Bevilaqua, S.; Clapis, A.; Maino, G. (Centro Informazioni Studi Esperienze, Milan (Italy)). Jun 1980. Translation of Un Sistema Strumentale per Diagnosi Precoci di Rotture di Fasci Tubiere, Milan 1980. (CISE—1612). 28p. NTIS, PC A03/MF A01.

The report describes the application of an acoustic method for the early detection of loss of fluid at high temperature in power plants. The technique is based upon monitoring in an appropriate frequency band the noise existing in fluid under pressure or in ambient gas in a tubing system. The technique has been validated with optimal success, particularly in the case of high pressure boilers in the boiler feed water of steam generating plants. The instrumental surveillance system is extremely simple. The typical results obtained both in the experimental phase and in the actual industrial version will be reported.

56717 **Evaluating coal transportation options to upper New York.** Vrooman, K.D. pp 33-40 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

The majority, or about 70 percent, of the coal used in New York is delivered by rail. All major industrial areas of New York are served by mainline Class 1 track and most major users of coal are located on or near the mainline track where the service can be excellent. About 25 percent of the coal shipped to New York is delivered by truck. Most of this coal is used at the utility power plants in western New York and in the southern tier. Trucking distances are generally limited to less than 150 miles. The unavailability of railcars has caused consumers, including Niagara Mohawk, to depend more heavily on truck deliveries than would otherwise be dictated by economics. Niagara Mohawk has also utilized a rail/water delivery system to supplement rail delivery of coal from eastern Kentucky. At times of heavy demand and railcar shortages we have been able to maintain deliveries by directing rail shipments from Kentucky to Toledo, Ohio, for subsequent shipment by vessel to the Huntley plant on the east end of Lake Erie. This delivery system accounts for the balance of the deliveries not made by rail or truck to New York. In the years ahead we can expect an increased use of coal in New York. The major increase in use will result from the conversion of utility plants from oil to coal and from the construction of new coal-fired plants.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 56034, 56035, 56038, 56039, 56712, 57742, 58109, 58159, 58183

56718 (INIS-mf—7092, pp vp) **Nuclear power plant siting.** Sulkiewicz, M.; Navratil, J. (Terplan - Statni Ustav pro Uzemni Planovani, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The construction of a nuclear power plant is conditioned on territorial requirements and is accompanied by the disturbance of the environment, land occupation, population migration, the emission of radioactive wastes, thermal pollution, etc. On the other hand, a nuclear power plant makes possible the introduction of district heating and increases the economic and civilization activity of the population. Due to the construction of a nuclear power plant the set limits of negative impacts must not be exceeded. The locality should be selected such as to reduce the unfavourable effects of the plant and to fully use its benefits. The decision on the siting of the nuclear power plant is preceded by the processing of a number of surveys and a wide range of documentation to which the given criteria are strictly applied.

56719 (INIS-mf—7092, pp vp) **Climatic impacts of nuclear power plant cooling towers.** Skulec, S. (Hydrometeorologicky Ustav, Bratislava (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The problems are discussed relating to the impact of waste heat from cooling towers of nuclear power plants on the energy balance in the atmosphere. The potential impacts from the release of waste heat and water from wet cooling towers into the ambient atmosphere are given.

56720 (INIS-mf—7092, pp vp) **Assessment of thermal emission impacts of nuclear power plants and possible application of physical modelling of dispersion.** Mikyska, L.; Cerny, F. (Vyzkumny Ustav Energeticky, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The impacts are described of the operation of cooling towers of nuclear power plants on the microclimate of the respective area and the significance is discussed of their modelling. A measuring tunnel was developed for physical modelling of the diffusion of emissions from stacks. The physical modelling used proved to be very suitable especially in case of the migration of emissions over hilly and mountainous terrain and in built-up areas. In such areas it helps find the optimal height of the stack, such as would not affect the town in the vicinity of the nuclear power plant, to ascertain the impact of high-rise buildings, etc., and to study the migration of emissions from nuclear power plants and the shape of the plume of water vapour from the cooling towers.

56721 **(INIS-mf—7092) Nuclear power and the environment: conference proceedings.** Strba, J. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1979. 176p. (In several languages). (CONF-7904193—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE82780705.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

Items within the scope of EDB have been entered individually into the data base. (ACR)

56722 **(NP—2750472) Pilot plant investigation of mercury retention in bay filters applied to coal fired boilers. First report.** Lindau, L. (Svenska Flacktfabriken AB, Vaexsjoe. Industrial Div.). Aug 1979. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750472.

It has been formerly reported (from one single source), that the small amount of mercury present in flue gases from coal firing can be collected with considerable success in an ordinary bag filter. In order to further investigate this effect, the performance in this respect of a small pilot bag filter is investigated. The first measurements show encouraging results.

56723 **(DOE/ET/10123—1171) Fabric-filter design for application in the fluidized-bed combustion of coal.** (McKee (Davy) Corp., Cleveland, OH (USA)). [nd]. Contract AC21-76ET10123. 44p. NTIS, PC A03/MF A01. Order Number DE82018827.

Various emission control devices, for FBC installations using a variety of fuels, are reviewed. These devices include scrubbers, electrostatic precipitators, granular beds, cleanable high efficiency air filters and baghouses. Dust filtration tests conducted at the Georgetown University FBC are described. Bagfilter cleaning techniques are compared. Special blinding problems peculiar to Georgetown but applicable to other FBC's with bagfilters are described. Several fabrics and finishes are compared and selection criteria are developed. Guidelines are presented for selection of baghouse design parameters. Baghouse operating procedures to prevent blinding and to maintain low baghouse pressure drop are stated. Testing procedures for optimizing baghouse performance are suggested. An extensive section for trouble-shooting prevalent baghouse problems is included. Finally, areas for further research and development are identified.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 57119, 57120, 57121

56724 **(CONF-820549—2) Power-system transient-stability analysis: a Hamiltonian approach.** Kumagai, S.; Wu, F.F. (California Univ., Berkeley (USA); Osaka Univ., Suita (Japan). Faculty of Engineering). 1982. Contract AC01-79ET29364. 4p. NTIS, PC A02/MF A01. Order Number DE82015636.

From International symposium on circuits and systems; Rome, Italy (10 May 1982).

Portions of document are illegible.

A nonlinear dynamic circuit model is proposed to represent the differential-algebraic equations arising from the analysis of power system transient stability. By using the circuit-theoretic model, we drive the conditions for the existence of Hamiltonian formulation of power systems.

56725 **(CONF-820735—1) Distribution energy-control-center experiment.** McConnell, B.W.; Reddoch, T.W.; Purucker, S.L.; Monteen, L.D. (Oak Ridge National Lab., TN (USA); Athens Utilities Board, TN (USA)). 1982. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE82018258.

From IEEE Power Engineering society summer meeting; San Francisco, CA, USA (18 Jul 1982).

The ultimate goal of integrating the generic functions presently described as supervisory control and data acquisition, load management, and distribution feeder automation into a single system has led to the proposed concept of a distribution energy control center (DECC). An experiment is being conducted on the

Athens Utilities Board's (AUB) distribution network in the Tennessee Valley Authority (TVA) service area. When successfully implemented, the installed hardware/software could become a test bed for future end use and distribution automation experiments. The DECC system will feature distribution automation and control concepts, develop closed loop control of feeder and substation functions, and extend and examine various load management concepts. DECC will be linked to TVA's bulk power control system.

56726 **(EPRI—325) Distribution transformer tank pressure study. Final report.** Goodman, E.A. (Allis-Chalmers Corp., Pittsburgh, PA (USA). Overhead Distribution Transformer Div.). Feb 1976. 65p. NTIS, PC A04/MF A01. Order Number DE82901828.

Portions of document are illegible.

This study provides calculated static pressures which may occur within faulted oil filled distribution transformers as a result of arcing and gas generation under known conditions such as air space, specific fuses, and specific pressure relief devices; and unknown quantities such as actual fault current, arc length, arc location, and gas temperatures. This report includes tables of calculated pressures for a wide range of transformer air spaces, a selection of pressure relief devices, and a wide range and variety of circuit protecting fuses. In each case the calculation of pressure covers a full range of fault currents, the basic unknown variable. Most protective fusing used for overhead, pad-mount, or submersible distribution transformers is likely to be included in these tables. Thus a utility engineer should find in the appropriate tables enough information to guide him in formulating operating procedures, in estimating the magnitude of required transformer tank strength, in evaluating the effectiveness and non-effectiveness of pressure relief devices, in reviewing fusing practices, in pin-pointing, distribution system locations requiring special attention, and in reassuring himself of proper coordination between fusing, available fault current, and transformer mechanical reliability. Several examples of application of this guide are given.

56727 **(EPRI-EL—983-Vol.2) Long-term power system dynamics, Phase III. Volume 2. LOTDYS user's guide. Final report.** Turner, A.E.; Schulz, R.P. (General Electric Co., Schenectady, NY (USA). Electric Utility Systems Engineering Dept.). May 1982. 482p. NTIS, PC A21/MF A01. Order Number DE82906432.

Portions of document are illegible.

Work performed to study Long-Term Power System Dynamics is reported. The objectives of the research project were: to extend the work already completed for EPRI by testing the Long Term Dynamic Simulation program, LOTDYS, in the analysis of several power system disturbances; to document LOTDYS for utility use; to examine the sensitivity of long term dynamic analyses to data and model changes; to identify and evaluate alternate measures for improving the capability of power system to withstand cascading failures; to provide guidelines for data for long term dynamics analyses; and to assist the University of Tennessee in developing a pressurized water reactor power plant model. The principal efforts of the project were in the conduct of simulation studies of four power system incidents, chosen to span the range of major system emergency conditions. The Topical reports of these studies are included in Section 2. Generally, it was concluded that long term studies may be usefully made, and that data pose the greatest difficulty in these analyses. Specific conclusions and recommendations regarding data needs, modeling, and conduct of studies are presented. The final report is in two volumes; this volume is the LOTDYS User's Guide, describing the program and its use.

56728 **(EPRI-EL—2395) Phototransistor switch for breaker applications. Final report.** Temple, V.A.K.; Holroyd, F.W. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). May 1982. 115p. NTIS, PC A06/MF A01. Order Number DE82904374.

Portions of document are illegible.

In order to survive the stresses inherent in opening mechanical circuit breakers under high power fault conditions, such breakers have traditionally been extremely large, rugged, and expensive. This report details an effort to develop a directly light-driven transistor with a view toward installing it in parallel with the mechanical breaker to relieve these stresses. This development divides into 3 main areas: first, the development of process suitable for fabricating high voltage transistors; second, a comprehensive set of calculations covering the most important aspects of design, fabrication, and operation of the device; and third, experimental measurements on prototype devices fabricated using the process developed. The calculations indicate that although it is possible to fabricate a high voltage-high current phototransistor, such a device is inherently incapable of operating efficiently under those conditions. This was verified on prototype devices which did achieve 1200V breakdown voltage, and did operate at up to 230 A/cm^2, but whose gain, even after amplification in a Darlington configuration, reached only about 40 before falling off again at high currents.

56729 **(EPRI-EL—2443-Vol.1) Basic transformer-life characteristics. Volume 1. Overload characteristics and life-test evaluation. Final report.** Kaufmann, G.H. (General Electric Co., Pittsfield, MA (USA). Large Power Transformer Dept.). Jun 1982. 172p. NTIS, PC A08/MF A01. Order Number DE82905850.

This report describes the results of experimental studies related to transformer survivability. It deals with the behavior of typical power transformer insulation systems during short-time exposure to elevated temperatures, and it provides some insight into failure mechanisms associated with gas bubble evolution within the insulation structure. Another important phase of the program involved the development and exploratory evaluation of a functional test program which may be used for determining the life expectancy characteristics of power transformers. Still another investigation resulted in the development and evaluation of an overload test procedure for power transformers. A feasibility study on a new type of thermal sensor for possible use as a winding hot spot sensor yielded promising results. The data presented is expected to be of help in developing improved transformer operating practices and in permitting an assessment of failure risks associated with particular service conditions.

56730 **(EPRI-EL—2443-Vol.2) Basic transformer-life characteristics. Volume 2. Evaluation of a Fluoroptic /sup TM/ thermometer as a hot-spot sensor for power transformers. Final report.** Kaufmann, G.H. (Luxtron Corp., Mountain View, CA (USA); General Electric Co., Pittsfield, MA (USA). Large Power Transformer Dept.). Jun 1982. 36p. NTIS, PC A03/MF A01. Order Number DE82906448.

The utility industry has long expressed the need for temperature instrumentation capable of monitoring the hottest spot of a transformer winding in service. The Fluoroptic temperature sensor concept developed by Luxtron Corporation is evaluated. The sensing element consists of an optical fiber with a temperature sensitive tip made of a rare earth phosphor. The excellent dielectric properties of probe materials, and the results of short-time survival studies on measuring probes and accessories in a simulated transformer environment tend to confirm that this technology may be suitable for transformer service. Specific design and material problems which must be resolved before a viable system can be developed are identified in the report.

56731 **Hybrid particle traps and conditioning procedure for gas insulated transmission lines.** Cookson, A.H.; Dale, S.J. (to Department Of Energy). US Patent 4,330,682. 18 May 1982. Filed date 14 Nov 1980. vp.

PAT-APPL-206755.

A gas insulated transmission line includes an outer sheath, an inner conductor within the outer sheath, insulating supports supporting the inner conductor within the outer sheath, and an insulating gas electrically insulating the inner conductor from the outer sheath. An apertured particle trapping ring is disposed within the outer sheath, and the trapping ring has a pair of dielectric members secured at each longitudinal end thereof, with the dielectric members extending outwardly from the trapping ring along an arc. A support sheet having an adhesive coating thereon is secured to the trapping ring and disposed on the outer sheath within the low field region formed between the trapping ring and the outer sheath. A conditioning method used to condition the transmission line prior to activation in service comprises applying an ac voltage to the inner conductor in a plurality of voltage-time steps, with the voltage-time steps increasing in voltage magnitude while decreasing in time duration.

56732 Ac resonant charger with charge rate unrelated to primary power frequency. Watson, H. (to Department Of Energy). US Patent 4,329,595. 11 May 1982. Filed date 7 Dec 1979. vp.

PAT-APPL-101339.

An ac resonant charger for a capacitive load, such as a pfn, is provided with a variable repetition rate unrelated to the frequency of a multi-phase ac power source by using a control unit to select and couple the phase of the power source to the resonant charger in order to charge the capacitive load with a phase that is the next to begin a half cycle. For optimum range in repetition rate and increased charging voltage, the resonant charger includes a step-up transformer and full-wave rectifier. The next phase selected may then be of either polarity, but is always selected to be of a polarity opposite the polarity of the last phase selected so that the transformer core does not saturate. Thyristors are used to select and couple the correct phase just after its zero crossover in response to a sharp pulse generated by a zero-crossover detector. The thyristor that is turned on then automatically turns off after a full half cycle of its associated phase input. A full-wave rectifier couples the secondary winding of the transformer to the load so that the load capacitance is always charged with the same polarity.

56733 Gas insulated transmission line having tapered particle trapping ring. Cookson, A.H. (to Department Of Energy). US Patent 4,328,391. 4 May 1982. Filed date 19 Jan 1981. vp.

PAT-APPL-226334.

A gas-insulated transmission line includes an outer sheath, an inner conductor, insulating supports and an insulating gas. A particle-trapping ring is secured to each insulating support, and it is comprised of a central portion and two tapered end portions. The ends of the particle trapping ring have a smaller diameter than the central portion of the ring, so as to enable the use of the particle trapping ring in a curved transmission line.

56734 Dispatched control for normal conditions on the HVAC or compound HV-AC-DC systems. Zaborszky, J.; Whang, K.W. (Washington Univ, St. Louis, Mo, USA). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

The Dispatched Control principle is developed to assure on line economic production of power including losses while maintaining system wide frequency and tie line load setpoints as well as the AC and, if present, the DC voltage profiles. New feasible algorithms are introduced for the reactive power and multiterminal DC system controls. Previously published papers have treated the reevaluation of the Dispatched Control of real power generation or AGC. It is advocated here to treat system security not on line but as part of unit commitment combined with on line active emergency control. A new "Transjection Model" for the compound multiterminal HV-AC-DC system is introduced which emphasizes structural properties of such systems and is instrumental in developing a system wide, uniformly structured Dispatched Control. 12 refs.

56735 Effect of solar induced current on autotransformer tertiary windings. Aspnes, J.D.; Akasofu, S.I. (Univ of Alaska, Fairbanks, USA). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

Experimental results are presented showing the effect of solar induced current in the series and common windings of an autotransformer on tertiary winding current. The three-phase autotransformer is rated at 18 MVA and 138/69 kV. Current transformers on the tertiary winding phases supply current to several directional relays and an overcurrent relay in the application described. Thus tertiary current fluctuations have the capability of causing transmission line service interruptions. 10 refs.

56736 Accuracy of the Edgeworth approximation for LOLP calculations in small power systems. Levy, D.J.; Kahn, E.P. (Univ of Calif, Berkeley, USA). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

Because they speed numerical calculations and exhibit functional dependences, Edgeworth-type series are increasingly used to approximate and calculate LOLP's (Loss Of Load Probabilities). They are usually sufficiently accurate for large power systems (>15,000 MW), but can be very inaccurate for small systems or those with low forced outage rates. This is because the approximating Edgeworth-type series are appropriate only for continuous probability densities, while discrete lattice-type density functions describe a typical power systems's probability properties. This paper investigates these inaccuracies for small systems (≦5000 MW), working out specific examples in a numerical approach and examining underlying functional dependences in an analytic approach. 19 refs.

56737 Load representation in power system stability studies. Concordia, C.; Ihara, S. pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

Proper representation of load is important in power system stability studies, but it is a difficult task. Load modeling is qualitatively different from generator modeling in many aspects. Composition of load needs to be reliably estimated, models of different components must be combined to obtain a reasonably manageable overall system model, and field measurements are not at all easy. This paper discusses in turn the effects of load characteristics on system performance, the load composition and component characteristics, and the available tests results. 56 refs.

56738 HVDC-AC harmonic interaction - I. Development of a harmonic measurement system hardware and software. Breuer, G.D.; Chow, J.H.; Gentile, T.J.; Lindh, C.B.; Numrich, F.H.; Lasseter, R.H.; Addis, G.; Vithayathil, J.J. pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

This paper is Part I of a two part series. The two papers report part of the research project RP-1138 sponsored by EPRI and BPA on HVDC-AC System Interaction from AC Harmonics. The two papers deal with the harmonic impedance measurement of Bonneville Power Administration's (BPA) system as seen from the Celilo HVDC substation, the development of analytical techniques to calculate the harmonic impedance of the system, and comparison of the calculated and measured results. Part I discusses the detail design of the instrumentation system, the data recording system and the validation of the accuracy of the overall instrumentation system used in the measurement of the harmonic system impedance. The accuracy of the measurements was validated by comparisons to known impedances of a capacitor and filter where the data were analyzed up to the 49th harmonic. The measured values of the known impedances when compared to the mid-harmonic range. Beyond the mid-range, the signals become very small and the accuracy of the data deteriorates. 2 refs.

56739 Physical model of electric aging and breakdown of extruded polymeric insulated power cables. Bahder, G.; Garrity, T.; Sosnowski, M.; Eaton, R.; Katz, C. Sr. (Cable Technol Lab Inc, New Brunswick, NJ, USA). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

The paper postulates a physical model of electric aging and breakdown of polymeric insulated high voltage cables and substantiates this model with results of tests. In accordance with the model, scission of molecular chains and formation of craters at discharging voids are responsible for the electric aging and voltage breakdown of polymeric insulation. It has been well established that gases and liquids permeate through polymers such as polyethylene (PE), crosslinked polyethylene (XLPE) and ethylene propylene rubber (EPR). A method for the rapid determination of threshold voltage by means of voltage breakdown tests has been developed. These tests indicate that at voltages above the threshold voltage the breakdown voltage decreases with an increase of time of voltage application. At voltages below the threshold voltage electric breakdown is not expected. 32 refs.

56740 **Bad data rejection properties of weighted least absolute value techniques applied to static state estimation.** Kotiuga, W.W.; Vidyasagar, M. (Univ of Waterloo, Ont, Can). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

A new method for obtaining an estimate of the state of a power system using weighted least absolute value (WLAV) techniques is presented. This paper shows how the WLAV estimator simultaneously detects and rejects bad data while obtaining an accurate estimate of the state. The test results presented show that the WLAV estimates, obtained with or without bad data present, are comparable to the estimates obtained by a weighted least squares (WLS) estimator using only good data. 13 refs.

56741 **Power system identification by fitting structured models to measured frequency response.** Hauer, J.F. (Bonneville Power Adm, Portland, Oreg, USA). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; Institute of Electrical and Electronics Engineers (1981).

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (26 Jul 1981).

Methods for determining dynamic system models from test data have been developed at the Bonneville Power Administration (BPA), in support of HVDC Modulation and other projects. Associated computer routines allow multiple sets of frequency response measurements, and accomodate loops and other structural features in the model. Fitting criteria include both gain and phase in the error measures, with a choice of constrained minimization algorithms. These routines have been interfaced to the BPA Electromagnetic Transients Program for state-space modeling of frequency dependence in transmission lines, and have digital-filter design capabilities. 24 refs.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 58260

56742 **(EPRI-NP—2507) Value assessment aid to complex decision making. Final report.** Humphress, G.; Lewis, E. (Southwest Research Inst., San Antonio, TX (USA)). Jul 1982. 113p. NTIS, PC A06/MF A01. Order Number DE82905815.

Portions of document are illegible.

Value assessment (VA) is a new decision aid that can improve the performance of decisionmakers confronted with multiple attributes and conflicting objectives. Managers who are not supported by formal decision aids turn to various "satisficing" or effort-reducing biases that can lead to serious errors in the decisionmaking process. Value assessment, on the other hand, is an optimizing approach to problem-solving behavior. VA helps decisionmakers overcome the tendency to turn to effort-reducing biases by reducing the complexity of making tradeoffs and weighing all available information. Many of the issues which confront modern electric utility managements are complex, multiple attribute problems which must be viewed from engineering, financial and socio-political perspectives simultaneously. Added to this are the complications contributed by factors like uncertainty, risk, incomplete information and conflicting objectives among the public it serves. This is the complex decisionmaking arena which VA is intended to support.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 56417, 56879, 56898, 56899, 56905, 56977, 56990, 56993, 56995, 57003, 57086, 57409, 58186

56743 **(EPRI-NP—2240) Disturbance analysis and surveillance system: scoping and feasibility study. Final report.** Gallagher, J.M. Jr. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Jul 1982. 272p. NTIS, PC A12/MF A01. Order Number DE82905844.

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A joint study made by Commonwealth Edison Company, Sargent and Lundy, Westinghouse Electric Corporation, and Systems Control, Inc., to establish the scope of a disturbance analysis and surveillance system (DASS) for a plant-wide availability and safety application, and to establish the appropriate engineering and design methods for creating the plant-specific models for such a system. This report contains the results of that study, including application of DASS design concepts to two trial examples. Estimates of engineering, software, and hardware resources necessary to implement a plant-wide system have been made, and plans for a phased implementation of DASS are recommended.

56744 **(EPRI-NP—2291-Vol.1) SPEAR-BETA fuel performance code system. Volume 1. General description. Final report.** Christensen, R. (Entropy Ltd., Lincoln, MA (USA)). Apr 1982. 218p. NTIS, PC A10/MF A01. Order Number DE82903280.

Portions of document are illegible.

This document provides a general description of the SPEAR-BETA fuel reliability code system. Included is a discussion of the methodology employed and the structure of the code system, as well as discussion of the major components: the data preparation routines, the mechanistic fuel performance model, the mechanistic cladding failure model, and the statistical failure model.

56745 **(EPRI-NP—2429-Vol.2) Steam turbine disc cracking experience. Volume 2. Data summaries and discussion. Final report.** Lyle, F.F. Jr.; Burghard, H.C. Jr. (Southwest Research Inst., San Antonio, TX (USA)). Jun 1982. 67p. NTIS, PC A04/MF A01. Order Number DE82905834.

The objectives of Tasks 1 and 2 of RP 1398-5, Cracking of Steam Turbine Discs, are to identify key variables for cracking in bores and keyways and in rim attachments of shrunk-on discs used in low-pressure (LP) rotors in US nuclear power plants. A review was conducted of available data concerning disc cracking experience in other countries, factors governing stress corrosion cracking of low-alloy steels, and factors determining environments present in LP turbines. Disc cracking experience in US plants were determined from a survey of US utilities and a series of visits to utilities.

56746 **(EPRI-NP—2454) Comparison of generic BWR-MSIV configurations. Final report.** Webber, A.H. (Atwood and Morrill Co., Inc., Salem, MA (USA)). Jun 1982. 91p. NTIS, PC A05/MF A01. Order Number DE82905806.

This report describes the comprehensive testing and offers the appropriate corrective actions that pertain to the 26-inch Y-pattern Main Steam Isolation Valve (MSIV). These corrective actions are intended to improve the valve performance capability in achieving the seat leakage requirements of the Local Leak Rate Test (LLRT). The LLRT is imposed by regulatory requirements and is conducted during refuelling outages. A test and measurement program was developed to investigate the contributory factors involved in valve leakage and a specially designed Seat Distortion Measuring Tool (SDMT), provided by the General Electric Company, facilitated measurements of the MSIV's poppet and pilot valve seat surfaces. The results of the tests support the design and functional integrity of the MSIV when operated at normal plant site loads and where a diligent maintenance program is employed.

56747 (EPRI-NP—2458) **Literature survey, numerical examples, and recommended design studies for main-coolant pumps. Final report.** Allaire, P.E.; Barrett, L.E. (Vibco Research, Inc., Charlottesville, VA (USA)). Jun 1982. 149p. NTIS, PC A07/MF A01. Order Number DE82905836.

This report presents an up-to-date literature survey, examples of calculations of seal forces or other pump properties, and recommendations for future work pertaining to primary coolant pumps and primary recirculating pumps in the nuclear power industry. Five main areas are covered: pump impeller forces, fluid annuli, bearings, seals, and rotor calculations. The main conclusion is that forces in pump impellers is perhaps the least well understood area, seals have had some good design work done on them recently, fluid annuli effects are being discussed in the literature, bearing designs are fairly well known, and rotor calculations have been discussed widely in the literature. It should be noted, however, that usually the literature in a given area is not applied to pumps in nuclear power stations. The most immediate need for a combined theoretical and experimental design capability exists in mechanical face seals.

56748 (EPRI-NP—2483) **Assessment of BWR fuel-channel lifetimes. Final report.** Gorman, J.A.; Lipsey, G.W. (Dominion Engineering, Inc., McLean, VA (USA)). Jul 1982. 167p. NTIS, PC A08/MF A01. Order Number DE82905849.

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The factors potentially limiting BWR fuel channel lifetimes are reviewed including interaction with control rod blades, interaction with incore instruments, bypass flow, and corrosion. Interaction with control rod blades - channel deformation resulting in encroachment on control rod blades, with potential adverse effects on the control rod blades' ability to move freely - is identified as the mechanism most likely to limit channel lifetime. In addition, interaction of channels with incore instruments can result in indicated core power asymmetries; precluding such interaction can permit re-use of some channels. Increased bypass flow can affect thermal-hydraulic safety limits when re-used channels are placed on new high power fuel assemblies, and this effect could potentially limit re-use of channels. Channel management methods suitable to extend fuel channel lifetimes to two full fuel assembly lifetimes are identified. Recommendations for further work to permit a larger percentage of channels to be used for two full fuel assembly lifetimes are identified.

56749 (NUREG/CR—2468) **State-of-practice review of ultrasonic in-service inspection of Class I system piping in commercial nuclear power plants.** Morris, C.J.; Becker, F.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1982. Contract AC06-76RL01830. 75p. (PNL—4026). GPO $5.00.

The Pacific Northwest Laboratory conducted a survey to determine the state of practice of ultrasonic in-service inspection of primary system piping in light water reactors. Personnel at four utilities, five inspection organizations, and three domestic reactor manufacturers were interviewed. The intention of the study was to provide a better understanding of the actual practices employed in in-service inspection of primary system piping and of the difficulties encountered.

56750 (NUREG/CR—2799) **Evaluation of events involving decay-heat-removal systems in nuclear power plants.** Haried, J.A. (Oak Ridge National Lab., TN (USA)). Jul 1982. Contract W-7405-ENG-26. 101p. (ORNL/NSIC—209). NTIS, PC A06/MF A01 - GPO $5.50.

This report reviews and evaluates events placed in the NSIC file involving the removal of decay heat in US commercial boiling- and pressurized-water reactors from June 1979 through June 1981. The information was collected from operating experiences, licensee event reports, system designs in safety analysis reports, and other regulatory documents. The results were collated and analyzed according to safety significance and cause of event. Thirty-eight reported events in these 2.1 years meet the criteria for safety significance. Steam bubble formation in the reactor vessel head during natural circulation cooldown at St. Lucie 1 was the most significant event; operator awareness of the possibility of this occurrence and preparedness for dealing with it was the most important recommendation. Cavitation of residual heat removal pumps during decay heat removal operation was the most common potentially significant event. Davis-Besse 1 had several instances in which an inadvertent signal to the safety features actuation system caused the operating residual heat removal pumps to align to the dry sump causing pump cavitation.

56751 (ZJE—247) **Programmable: logic equipment for ultrasound periodic inspections of reactor pressure vessels.** Haniger, L. (Skoda, Plzen (Czechoslovakia)). 1980. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82902821.

Portions of document are illegible.

This report presents a brief description of a programmable-logic equipment intended for ultrasound periodic inspections of power reactor pressure vessels and outlines a solution for inspecting the circumferential weld on pressure vessel head. Command words are taken from a punched tape reader. Czechoslovak RAM memories are used.

56752 **Neutron wave propagation in heterogeneous media and the interpretation of neutron noise in boiling water reactors.** Difilippo, F.C. (Oak Ridge Natl Lab, Tenn). *Nuclear Science and Engineering;* **80**: No. 2, 211-217(Feb 1982).

For a heterogeneous multiplying system, a one-group diffusion model is shown to exhibit two spatial eigenvalues (inverse relaxation lengths). In this paper, a one-group neutron diffusion model that accounts explicitly for heterogeneities of the system is applied. The existence of a short-range relaxation length is shown to be a direct consequence of the physical properties of a heterogeneous multiplying system. The existence of these two eigenvalues is relevant to interpretation of neutron noise measurements in boiling water reactors. 21 refs.

56753 **Geometrical view factors for radiative heat transfer within boiling water reactor fuel bundles.** Mandell, D.A. (Los Alamos Sci Lab, NM, USA). *Nuclear Technology;* **52**: No. 3, 383-392(Mar 1981).

Equations are presented for the view factors needed to calculate the radiative heat transfer in a a BWR bundle. Once these individual surfaces view factors are calculated, they can be grouped into a smaller number of rod groups by using symmetry. This reduces computer costs in large codes, but it necessary to do a sensitivity study to determine how many rod groups are needed for an accurate solution. 7 refs.

56754 **Air bubble oscillation frequencies in boiling water reactor pressure suppression pools.** Foody, B.E.; Huber, P.W. (MIT, Cambridge, Mass). *Nuclear Science and Engineering;* **80**: No. 2, 304-312(Feb 1981).

The effects of bubble interaction and boundary surfaces on the radial oscillation dynamics of multiple air bubbles in a liquid pool are analyzed. Quantitative predictions are obtained for the coupling between bubble phasing and the distribution of power over a range of frequencies, the crowding effect on bubble frequency when multiple bubbles are formed in a single pool, the effect on frequency of a bubble's rise from a point near the floor of a pool toward the free surface, and the frequency correction for test tank data when the design condition of interest is a discharge in a larger pool. 6 refs.

56755 **Analysis of residual stresses in welding by thermal-plastic finite element computations - applications to heat sink welding.** Brust, F.W.; Kanninen, M.F. (Battelle, Columbus Lab, OH). pp 1-6 of Failure prevention and reliability - 1981. New York, NY; ASME (1981).

From ASME conference on mechanical vibration and noise; Hartford, CT, USA (20 Sep 1981).

Intergranular stress corrosion cracking (IGSCC) of Type 304 stainless steel pipes used in boiling water reactor environments is caused in part by tensile weld induced residual stresses. Introducing compressive residual stresses at critical locations in the pipe by altering the weld fabrication process is thus desirable. A thermo-elastic-plastic finite element model can be utilized efficiently to analyze techniques for controlling weld induced residual stresses. This paper presents the results of assessing the effectiveness of one such remedial technique called heat sink welding. The analysis model was improved and then used to model the heat sink welding process to determine the heat sink welding parameters which produce the most desirable residual stress distribution in terms of preventing IGSCC in pipes. 20 refs.

56756 **Effect of increased regulation on capital costs and manual labor requirements of nuclear power plants.** Paik, S.; Schriver, W.R. (US Dep of Labor). *Engineering Economist;* **26**: No. 3, 223-244(1981).

An attempt is made to explain the impact of increasing governmental regulation on capital costs and labor requirements for constructing light water reactor (LWR) electric power plants. The principal factors contributing to these increases are: (1) market conditions and (2) increased regulation. General market conditions include additional costs attributable to price inflation of equipment, material, labor, and the increased cost of money. The central objective of this work is to estimate the impact of increasing regulation on plant costs and, conversely, on output. To do this it is necessary to isolate two opposing sets of forces which have been in operation during the period of major regulatory expansion: learning based upon plant design experience and economies of scale with increasing size (generating capacity) of newer plants. Conceptual models are specified to capture the independent effects of increasing regulation, learning, and economies of scale. Empirical results were obtained by estimating the models on data collected from industry experience during the 1967-1980 period. 23 refs.

56757 **Evaluation of the plutonium denaturing concept as an effective safeguards method.** Heising-Goodman, C.D. (MIT, Cambridge, Mass). *Nuclear Technology;* **50**: No. 3, 242-251(Oct 1980).

The effectiveness of denaturing plutonium with a /sup 238/ Pu heat spike was evaluated as a safeguards deterrent for light water reactor (LWR) fuel. The aspects examined include the percentage of /sup 238/Pu denaturant required to sufficiently protect reactor-grade plutonium from national and subnational diversion attempts, the production rate of denaturant in LWRs, and logistics requirements. 12 refs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 56262, 56358, 56417, 56743, 56744, 56745, 56747, 56749, 56750, 56751, 56756, 56757, 56878, 56879, 56900, 56901, 56905, 56945, 56959, 56961, 56971, 56975, 56977, 56985, 56990, 56993, 56994, 56995, 57086, 57352, 57353, 57354

56758 **(DOE/ET/34213—9) Characterization and irradiation program: extended-burnup lead test assembly (Mark BEB).** Coleman, T.A. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Dec 1981. 70p. (BAS—1682). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82014537.

Portions of document are illegible.

The immediate goal of the project is to extend the burnup of light water reactor fuel assemblies to 50,000 MWd/mtU batch average burnup. To achieve this goal, four extended-burnup lead test assemblies (Mark BEBs) have been designed, manufactured, characterized, and inserted in Arkansas Nuclear One, Unit 1 (ANO-1) for irradiation. This report describes the design and pre-irradiation characterization of the lead test assemblies, which incorporate changes to the fuel rod and fuel assembly structural cage of standard 15 x 15 fuel assemblies to extend their burnup capability. These assemblies have a burnup capability greater than 50,000 MWd/mtU and are to be irradiated in ANO-1 during cycles 5, 6, and 7 to demonstrate their ability to safely and reliably attain this extended burnup. Irradiation began on March 16, 1981.

56759 (INIS-mf—7093, pp vp) **Manufacture of steels for reactor pressure vessels.** Mocek, J.; Kepka, M.; Skala, J.; Jirsa, J. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The technology is described and assessed employed by SKODA Trust in Plzen in making steels for reactor pressure vessels in open-hearth and electric arc furnaces. Ingot melts were investigated of steel 15Kh2MFA of 110 and 135 tons in weight, of steel 18Kh2MFA of 85 tons in weight, and steel 15Kh2NMFAA of 70 and 135 tons in weight. A detailed description is presented of steel refining technology in ladles of the ASEA-SKF type used in the USSR. Both technologies were found satisfactory for the manufacture of reactor pressure vessel steels. (J.B.).

56760 (INIS-mf—7093, pp vp) **Problems of steel 22K manufacture for plates.** Chvojka, J. (Vitkovicke Zelezarny Klementa Gottwalda, Ostrava (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The manufacture is described of steel 22K for making plates used in the production of steam generators and pressurizers for WWER 440 reactors. In the manufacture of plates of up to 80 mm in thickness, direct rolling from ingots was tested which helped reduce production cost and shorten the production cycle while retaining the plate quality. (J.B.).

56761 (INIS-mf—7093, pp vp) **Mechanical properties of parts of WWER 440 pressure vessels.** Brynda, J.; Brumovsky, M. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

Statistical evaluations of approximately 30 melts for WWER 440 reactor pressure vessels showed good reproducibility of results which safeguards the good quality of semi-finished products from steels 15Kh2MFA, 18Kh2MFA and 25Kh3MFA. The quality is attained through balanced chemical composition and low contents of undesirable elements. The mechanical properties achieved guarantee high safety levels of the pressure vessels. The results of mechanical tests are shown in a table.

56762 (INIS-mf—7093, pp vp) **Materials problems of nuclear reactors.** Pilous, V. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The requirements are presented for the technology of manufacture of the WWER 440 reactor pressure vessel with respect to operating reliability and safety.

56763 (INIS-mf—7132, pp vp) **Structural materials in nuclear power engineering.** Koutsky, J. 1980. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on contemporary Scandinavian-American issues; Minneapolis, MN, USA (29 Feb 1980).

State-coordinated tasks are discussed in which the Nuclear Research Institute is participating. In the first stage, resistance to radiation damage is determined of steels (CrNiMoV) used for the manufacture of 440 and 1000 MW pressure vessels and compared with that of steels A-533-B, SA-508. In the following stage, the effect is studied of operating conditions on embrittlement of pressure vessel materials, mainly the combined effects of hydrogen and radiation on the properties of steel CrMoV. Materials research at UJV is also focused on the research of the properties of nuclear fuel cladding tubes. It is divided into three stages, viz., the research of the properties of Zr-1Nb alloy tubes with artificial defects, radiation experiments and post-irradiation assessment of prospective Zr alloys, the research of welded joints of WWER type fuel elements.

56764 (INIS-mf—7132, pp vp) **Research of cladding materials for light water reactors.** Kocik, J. 1980. (In Czech). Dep. NTIS (US Sales Only).

From Workshop on contemporary Scandinavian-American issues; Minneapolis, MN, USA (29 Feb 1980).

The research project "Radiation and Post-irradiation Research of Zr Alloys" in which UJV Rez is engaged involves the study into the properties of cladding tubes from the Zr-1Nb alloy with interior defects, the properties of prospective Zr alloys in the radiation situation, and the properties of welded joints of Zr alloys.

Zr-1Nb alloy is used for WWER type reactors while multicomponent alloys Zr-Cu-Fe-Mo-V are being developed suited to higher operating parameters of reactors.

56765 **(Juel—1732) Measurement of steady and unsteady pressure distribution around cylinders in cross-flow with regard to fluidelastic effects.** Mohr, K.H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Aug 1981. 155p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82904580.

Portions of document are illegible.

Tubes of heat exchangers are excited to mechanical vibrations by unsteady flow forces. Up to now no information on the character of these forces and the interdependence between tube vibrations and the flow forces is known. An experimental device is described with which steady and unsteady forces acting on a tube and the mechanical response of the tube to these forces can be measured. The test tube and its neighbours were either fixed or free to vibrate. At first a single cylinder in cross-flow was investigated to prove the reliability of the test procedure. After that experiments with four in-line tube banks with transverse and longitudinal pitches ranging from 1.15 to 2.88 tube diameters were performed. The aerodynamic forces were calculated on line by means of an analogue computer. Simultaneously the mechanical response of the tubes was registered.

56766 **How St. Lucie 2 kept rein on thermal effects.** Stockton, L.E. (Price Brothers Co). *Power;* **125**: No. 12, 32-33(Dec 1981).

Design and construction of the condenser cooling-water discharge line from St. Lucie 2 nuclear power plant presented problems in the areas of environmental requirements, pipeline fouling from marine growth, and civil engineering. Special design, based in part on model experiments and in part on experience, established conditions for success with the new line. Methods and results are described, which are of interest to systems with similar oceano-discharge conditions.

56767 **Bond graph modeling of nuclear reactor dynamics.** Tylee, J.L. (Edgerton, Germeshausen & Grier Inc, Idaho Falls, Idaho). *American Society of Mechanical Engineers, [Paper];* No. 81-WA/DSC-11, 1-7(1981).

A tenth-order linear model of a pressurized water reactor (PWR) is developed using bond graph techniques. The model describes the nuclear heat generation process and the transfer of this heat to the reactor coolant. Comparisons between the calculated model response and test data from a small-scale PWR show the model to be an adequate representation of the actual plant dynamics. Possible applications of the model in an advanced plant diagnostic system are discussed. 6 refs.

56768 **Using fuel performance to determine operating limit uncertainty allowance.** Carew, J.F.; Diamond, D.J. (Brookhaven Natl Lab, Upton, NY, USA). *Nuclear Technology;* **50**: No. 3, 252-256(Oct 1980).

An analytic relationship between fuel failure (defined as exceeding a prescribed fuel limit) due to measurement uncertainties and operating limit uncertainty allowance is derived. The expected number of fuel failures due to measurement uncertainties is evaluated for a set of selected power distributions and a general bounding power distribution. The expected number of fuel pins challenging limits is determined as a function of uncertainty allowance for selected core power distributions. 5 refs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 56915, 56916, 56918, 56955, 56977, 56986

56769 **(DOE/SF/02034—T66) Program prioritization system user requirements document for Gas Cooled Reactor Associates.** (Gas-Cooled Reactor Associates, La Jolla, CA (USA); Management Analysis Co., San Diego, CA (USA)). 22 Sep 1981. Contract AC03-78SF02034. 40p. NTIS, PC A03/MF A01. Order Number DE82008496.

Portions of document are illegible.

Efficient management of the national HTGR program requires the establishment of an information system that will facilitate a more rational allocation of resources and task prioritization consistent with program policies. The system described in this document provides a data analysis mechanism for processing top level summary status and planning information in a rapid, timely and selective manner. Data produced by the system can be used by management to provide a rational basis for prioritizing tasks, evaluating program changes and program planning regarding costs, schedules and overall program development logic. The purpose of this document is to delineate the program prioritization system (PPS) requirements for use as a guide to acquiring and implementing the system.

56770 **(DOE/SF/02034—T75) Topical report on alternate refueling concepts.** (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Jun 1981. Contract AC03-78SF02034. 40p. NTIS, PC A03/MF A01. Order Number DE82008218.

Portions of document are illegible.

This report presents the design, cost and construction schedule implications of constructing the short-term fuel storage facility either above or below the reactor containment building base mat. The short-term fuel storage facility is required as part of the reference in-vessel refueling system. This report will be used together with considerations for refueling reliability, maintenance accessibility, overall plant layout improvements and costs for additional refueling equipment to make a recommendation to the Technical Advisory Committee for the location of the short-term fuel storage facility in the reference plant.

56771 **(GA-A—16637) History of and prospects for gas-cooled reactors in the United States.** Simon, R.H. (General Atomic Co., San Diego, CA (USA)). May 1982. Contract AT03-76SF70046. 190p. NTIS, PC A09/MF A01. Order Number DE82015390.

The Fort St. Vrain Nuclear Generating Station, which is the only operating HTGR in the United States and which recently achieved 100% power, is described. The report covers the use of helium-cooled reactors for electricity generation, cogeneration of steam for industrial processes and for electric power, and process heat. Three types of reactors are described for electricity generation: the steam cycle HTGR, which is based on Fort St. Vrain; the gas turbine HTGR, which utilizes a direct cycle; and the Gas-Cooled Fast Breeder Reactor (GCFR), which is also based on Fort St. Vrain and which not only would produce electricity but would have the potential to achieve compound system doubling times of fissionable material of under ten years. The HTGR is particularly well suited for the cogeneration of steam and electric power. The cogeneration plant, which has the same nuclear steam supply system as the steam cycle HTGR, is described along with a number of possible industrial applications. The process heat HTGR is being designed to two versions: an 850°C core outlet temperature with an intermediate helium loop and a 950°C core outlet temperature with a reformer and steam generator in the primary circuit. The technical performance, fuel cycles, safety characteristics, and environmental impact of the HTGR and GCFR are also discussed in the report.

56772 **(Juel-Conf—38) Papers concerning fuel particles, fuel elements and graphitic materials for high temperature reactors presented at the 1980 annual conference Kerntechnik.** Rottmann, J. (comp.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Aug 1980. 51p. (CONF-8003173—Exc.). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82903771.

From Conference on fine particles, fuel elements, and graphite materials for high temperature reactors; Berlin, F.R. Germany (25 Mar 1980).

Portions of document are illegible.

This report is a compilation of the papers presented by staff of the Institute for Reactor Materials, KFA-Juelich, at the 1980 annual conference Reaktortechnik, held in Berlin, 25-27th March 1980. In the presentations, the questions of the characterization of fuel particles and the retention of fission products are dealt with, and special attention is given to fission product release at very high temperatures. One presentation deals with the disposal of fuel elements from the AVR. Another report presents the results of radiation experiments on the standard matrix material A3-3 of the THTR fuel elements; the changes in dimensions, creep coefficient and thermal conductivity were measured as functions of the fluence and the radiation temperature. Interim results obtained from long-term radiation experiments on reflector graphites for high and very high flux reactors are presented, and models for the calculation of dimensional changes in components subjected to fluctuating temperatures from data obtained in isothermal tests are discussed.

56773 **(LA-UR—82-1920) Thermal-stress analysis of a Fort St. Vrain core-support block under accident conditions.** Carruthers, L.M.; Butler, T.A.; Anderson, C.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 18p. (CONF-820650—7). NTIS, PC A02/MF A01. Order Number DE82019573.

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

A thermoelastic stress analysis of a graphite core support block in the Fort St. Vrain High Temperature Gas Cooled Reactor is described. The support block is subjected to thermal stresses caused by a loss of forced circulation accident of the reactor system. Two- and three-dimensional finite element models of the core support block are analyzed using the ADINAT and ADINA codes, and results are given that verify the integrity of this structural component under the given accident condition.

56774 **Method for fracturing silicon-carbide coatings on nuclear-fuel particles.** Tiegs, S.M.; Turner, L.J.; Van C. J.; Willey, M.G. (to Department Of Energy). US Patent 4,323,198. 6 Apr 1982. Filed date 29 Sep 1980. vp.

PAT-APPL-191613.

This invention is a device for fracturing particles. It is designed especially for use in "hot cells" designed for the handling of radioactive materials. In a typical application, the device is used to fracture a hard silicon-carbide coating present on carbon-matrix microspheres containing nuclear-fuel material, such as uranium or thorium compounds. To promote remote control and facilitate maintenance, the particle breaker is pneumatically operated and contains no moving parts. It includes means for serially entraining the entrained particles on an anvil housed in a leak-tight chamber. The flow rate of the gas is at a value effecting fracture of the particles; preferably, it is at a value fracturing them into product particulates of fluidizable size. The chamber is provided with an outlet passage whose crosssectional area decreases in the direction away from the chamber. The outlet is connected tangentially to a vertically oriented vortex-flow separator for recovering the product particulates entrained in the gas outflow from the chamber. The invention can be used on a batch or continuous basis to fracture the siliconcarbide coatings on virtually all of the particles fed thereto.

56775 **Nuclear reactor control.** Cawley, W.E.; Warnick, R.F. (to Dept. of Energy). US Patent 4,322,853. 30 Mar 1982. Filed date 27 Aug 1963. vp.

PAT-APPL-305245.

In a nuclear reactor incorporating a plurality of columns of tubular fuel elements disposed in horizontal tubes in a mass of graphite wherein water flows through the tubes to cool the fuel elements, the improvement comprising at least one control column disposed in a horizontal tube including fewer fuel elements than in a normal column of fuel elements and tubular control elements disposed at both ends of said control column, and means for varying the horizontal displacement of the control column comprising a winch at the upstream end of the control column and a cable extending through the fuel and control elements and attached to the element at the downstream end of the column.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 56397, 56423, 56942, 56954, 56964, 56965, 56966, 56977, 56984, 56992, 56997, 56998, 56999, 57000, 57001, 57004, 57005, 57006, 57411, 57413, 57414, 57415, 57416

56776 **(RISLEY-Trans—3322) Review of fast-reactor development in the USSR.** Kochetkov, L.A.; Bagdasarov, Yu.E. (UKAEA Risley Nuclear Power Development Establishment). [nd]. Translation of IAEA-SM-225/78. (CONF-780407—13-Trans.). 12p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82904668.

From Symposium on design, construction and operating experience of demonstration liquid metal fast breeder reactors; Bologna, Italy (10 Apr 1978).

Portions of document are illegible.

The paper reviews the history of sodium-cooled fast-reactor development in the Soviet Union. Initially there is a brief account of the results obtained in general scientific investigations and in the development and operation of experimental devices, rigs, and reactors. These investigations made it possible to formulate and give effect to the general principles underlying the Soviet approach to demonstration nuclear power plants of the BN-350 type. Construction and operation of the BN-350, and construction of the BN-600, are described. The characteristics of the BN-1600 stations now being designed for series construction are described and compared with those of BN-350 and BN-600.

56777 **(RISLEY-Trans—3370) Operating results of Phenix primary circuits. Super Phenix primary circuit.** Vial; Thevenin; Guidez; Sauvage; Schaller. (UKAEA Risley Nuclear Power Development Establishment). [nd]. Translation of IAEA-SM-225/11. (CONF-780407—15-Trans.). 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82906185.

From Symposium on design, construction and operating experience of demonstration liquid metal fast breeder reactors; Bologna, Italy (10 Apr 1978).

Portions of document are illegible.

Phenix has been in service since July 1974 and on January 31, 1978 had produced 380,750 MWd or 676 equivalent days full power. The primary circuit has been in sodium since January 13, 1973 and the maximum power developed in the circuit is 591 MW. Operation and maintenance of the Phenix primary circuit are reviewed. Design characteristics of the Super Phenix primary circuit are presented.

56778 **(RISLEY-Trans—4093) Development of fast reactors in France, March 1978-March 1979.** Vautrey, L. (UKAEA Risley Nuclear Power Development Establishment). [nd]. Translation of Fuel Assessment Group Note 111. (CONF-7903135—1-Trans.). 18p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82906189.

From 12. annual meeting of the IAEA International Working Group on fast reactors; Vienna, Austria (17 Mar 1979).

Portions of document are illegible.

This presentation comprises: a brief historic review of last year covering Rapsodie, Phenix, Super Phenix, and future stations; and a broad review of the progress of research and development over the last twelve months.

56779 **(DOE-tr—170) Turbulent flow at single and repeated rib roughnesses in a plane channel.** Meyer, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). [nd]. Translation of KFK-1764. 230p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE82021990.

Thesis. Submitted to Karlsruhe Univ., Germany. Work performed under United States-West Germany Fast Reactor Exchange Program.

The assumption of universal velocity profiles over smooth and rough surfaces is the basis for calculating the asymmetric flow in rough channels. In this work the parameters of the velocity profiles over two- and three-dimensional rectangular roughnesses are determined, and the feasibility of calculating these by means of a flow model around single roughnesses is analyzed. Measurements in fully developed turbulent flow in a rectangular channel with variable aspect ratio were performed. For different single roughnesses the pressure and drag coefficients and the reattachment lengths of the flow behind the ribs were determined. In channels with one and with both sides rough pressure and velocity profiles for the fully rough flow regime were measured. The results show that the slopes of the nondimensional velocity profiles in the smooth and rough zone decrease with increasing relative roughness height and increasing drag of the rough wall.

56780 (BARC—1118) **Coupled convective and conductive heat transfer by up-wind finite element method.** Kushwaha, H.S. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.). 1981. 37p. T. Order Number DE82904594.

Portions of document are illegible.

In this report, some of the concepts relating to finite element formulation of the Navier-Stoke's equations using mixed formulation and Penality formulation are discussed. The two different approaches for solution of nonlinear differential equations for two different types of formulation are described. Incremental Newton Raphson method can also be applied to mixed formulations. 12 figures.

56781 (BNL—30756) **LMFBR core design for low capital cost and low-sodium void.** Fischer, G.J. (Brookhaven National Lab., Upton, NY (USA)). Jan 1982. Contract AC02-76CH00016. 6p. (CONF-820609—74). NTIS, PC A02/MF A01. Order Number DE82019525.

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

The need to design LMFBR reactor cores as well as plants for lowest possible capital costs has been apparent internationally as well as in the US. At the same time it is also important to keep the sodium void reactivity gain as low as possible for safety reasons and it has always been important to assure a plant design which most effectively serves the operational needs of the utility. This paper describes a LMFBR core design which has evolved as a result of a recent effort to achieve these objectives.

56782 (DOE/SF/01035—T2) **LMFBR large valve development. Static sodium proof-of-principle (POP) test design and analyses interim summary report for the 12.0-inch rotating offset ball valve internals.** Smith, V.A.; Perschler, J.; Kinter, R.S. (Aerojet Mfg. Co., Fullerton, CA (USA)). Apr 1975. Contract AC03-76SF01035. 150p. D. Order Number DE82005407.

Portions of document are illegible.

This report updates progress made by AMCO to date in the development of the 12-inch rotating offset ball valve, for use in sodium isolation service for the LMFBR Demonstration Plant Intermediate Heat Transport System (IHTS). The work is being performed under Contract No. AT-(04-03)-1035 ERDA SAN. The design incorporates an offset rotating ball in conjunction with a flexible metal lip seal to provide shut-off in liquid sodium at elevated temperatures.

56783 (EPRI-NP—2316) **Component development for duplex tube steam generator for large LMFBR plant. Final report.** (FW Energy Applications, Inc., Livingston, NJ (USA)). Apr 1982. 166p. NTIS, PC A08/MF A01. Order Number DE82903852.

One type of steam generator which is applicable to a Liquid Metal Fast Breeder Reactor Plant is a straight, duplex tube unit with a shell bellows for thermal expansion and a single tubesheet with an integral leak detection system. Additional design data for the duplex tube concepts are provided by the development tasks which have been completed for the single tubesheet and the duplex tubes. The network of holes to provide an integral leak detection system in the single tubesheet and a probe to identify the leaking tube have been proven feasible. Leak detection grooves must be provided along the length of the tubes at the tube interface for complete leak detection monitoring. EBR-II mechanically bonded tubes and other mechanically bonded tubes with different manufacturing parameters were evaluated for chemical and mechanical properties, thermal cycling and thermal conductivity. The mechanically bonded tube heat transfer performance can degrade due to thermal cycling or from exposure to temperature above the creep range for the tube material. Tests with flat plates indicated that metallurgically bonded tubes can be made with integral leak detection paths. To use the duplex tube concept with higher temperatures, further development work is required with the metallurgically bonded tube.

56784 (INIS-mf—7093, pp vp) **Properties of structural materials for steam generators and other components of fast reactors, decisive for use at higher temperatures.** Abusinov, A.; Bina, V.; Holy, M.; Kneifl, M.; Pech, R. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The results are presented of testing ferritic steels Cr2.25Mo1Nb of the Sandvik HT8X6 make and steel 10Cr2.5Mo1NiNb, and of austenitic steels CSN 17249, 17346, 17349, 17341, and of steel 03Cr18Ni11 of the Sandvik 3R12 make, all used for steam generators and other components of fast reactors. The chemical composition, physical properties, such as the temperature coefficient of linear expansion, specific thermal conductivity, mean specific heat, and mechanical properties at 20 degC and after long-term annealing at 450 to 550 degC are shown for all materials. Also presented are the results of creep strength tests, the effect of carburizing on thermal fatigue resistance and data on the susceptibility of steel Sandvik HT8X6 to annealing crack formation of welded joints. (B.S.).

56785 (WAPD-TM—1350-Add.2) **Fission gas release from high burnup ThO_2 and ThO_2-UO_2 fuels irradiated at low temperature. (LWBR/AWBA development program).** Giovengo, J.F.; Goldberg, I.; Sphar, C.D. (Bettis Atomic Power Lab., Pittsburgh, PA (USA)). May 1982. Contract AC11-76PN00014. 22p. NTIS, PC A02/MF A01. Order Number DE82014873.

Fission gas release data are presented for five fuel rods irradiated at low fuel temperature (below 2700°F) with burnups up to 90,000 MWD/MTM. Four of these rods contained ThO_2-UO_2 (33.6 weight percent UO_2) fuel pellets; the fifth rod contained ThO_2 pellets. These data supplement fission gas release information previously reported for 54 rods containing ThO_2-UO_2 and ThO_2 fuel, some of which experienced fuel temperaures up to 5000°F and burnups to 56,000 MWD/MTM. These new data suggest that at burnups exceeding about 80,000 MWD/MTM a sharp increase in fission gas release occurs, possibly caused by microstructural changes in the fuel. This is similar to the behavior of UO_2 except that the increase occurs in UO_2 at lower burnup (approximately 40,000 MWD/MTM). The fission gas release calculational model previously reported has been modified to account for the observed increase in the low temperature component. The revised model provides a good best estimate of all the fission gas release data.

56786 (ZPR-TM—424) **Reaction rate calibration techniques at ZPPR for ^{239}Pu fission, ^{235}U fission, ^{238}U fission, and ^{238}U capture.** Brumbach, S.B.; Maddison, D.W. (Argonne National Lab., Idaho Falls, ID (USA)). 10 Jun 1982. Contract W-31-109-ENG-38. 28p. (ANL—82-38). NTIS, PC A03/MF A01. Order Number DE82019460.

Reaction-rate calibration techniques used at ZPPR are described for ^{239}Pu fission, ^{235}U fission, ^{238}U fission and ^{238}U capture. In addition to these absolute reaction rates, calibration techniques are described for fission-rate ratios and the ratio of ^{238}U capture to ^{239}U capture to ^{239}Pu fission. Uncertainty estimates are presented for all calibrations. Intercomparison measurements are reported which support the validity of the calibration techniques and their estimated uncertainties.

56787 **Liquid-metal-cooled reactor.** Hutter, E. (to Department Of Energy). US Patent 4,316,770. 23 Feb 1982. Filed date 21 Sep 1979. vp.

PAT-APPL-077821.

A perforated depressor plate extending across the bottom of the instrument tree of a fast breeder reactor cooperates with a circular cylindrical metal bellows forming a part of the upper adapter of each core assembly and bearing on the bottom of the depressor plate to restrict flow of coolant between core assemblies, thereby reducing significantly the pressure differential between the coolant inside the core assemblies and the coolant outside of the core assemblies. Openings in the depressor plate are slightly smaller than the top of the upper adapter so the depressor plate will serve as a backup mechanical holddown for the core. In addition coolant mixing devices and locating devices are provided attached to the depressor plate.

56788 **Laser cutting apparatus for nuclear core fuel subassembly.** Caruolo, A.B.; Walch, A.P. (to Department of Energy). US Patent 4,317,021. 23 Feb 1982. Filed date 22 Feb 1980. vp.

PAT-APPL-123861.

The object of the invention is to provide a system and apparatus which employs laser cutting to disassemble a nuclear core fuel subassembly. The apparatus includes a gantry frame (C) which straddles the core fuel subassembly (14), an x-carriage (22) travelling longitudinally above the frame which carries a focus head assembly (D) having a vertically moving carriage (46) and a laterally moving carriage (52), a system of laser beam transferring and focusing mirrors carried by the x-carriage and focusing head assembly, and a shroud follower (F) and longitudinal follower (G) for following the shape of shroud (14) to maintain a beam focal point (44) fixed upon the shroud surface for accurate cutting.

56789 **Experience with liquid-metal fast breeder reactor steam generators - U.S. design.** Stone, C.C.; Ford, J.A.; Tippets, F.E.; McDonald, J.S.; Grant, G.; Epstein, J.L. (Argonne Natl Lab, Ill, USA). *Nuclear Technology;* **55**: No. 1, 60-87(Oct 1981).

Sodium-heated steam generator development in the U.S. over the past 30 years has included design, manufacture, and operation or testing of numerous design concepts, including reactor plant and model test units. This paper summarizes the design and operational histories of early plant unit designs that were actually installed and operated in reactor plants. 20 refs.

56790 **EBR-II reactor core component gauging.** King, R.W. (ANL-Idaho, Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **38**: 710(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

56791 **Gas tag identification of failed reactor assemblies - 4. Analysis methods.** Figg, J.A.; McCormick, N.J.; Schenter, R.E.; Schmittroth, F. (Hanford Eng Dev Lab, Richland, Wash). *Nuclear Technology;* **50**: No. 1, 16-24(Aug 1980).

Gas tagging is a method for locating an assembly with breached pin cladding in a liquid-metal-cooled fast reactor. This paper reviews the design considerations and their recent application to a tag design for the Clinch River Breeder Reactor Project (CRBRP). Previously unreported work on the evaluation of tag ratio changes with reactor burnup is also discussed. A probabilistic method for identifying failed fuel and its implementatin in the failure location code TAFLA (Tagged Assembly Failure Location Analysis) is also summarized. 14 refs.

56792 **Irradiation performance of metallic driver fuel in Experimental Breeder Reactor II to high burnup.** Einziger, R.E.; Seidel, B.R. (Argonne Natl Lab, Idaho Falls, Idaho). *Nuclear Technology;* **50**: No. 1, 25-39(Aug 1980).

The Experimental Breeder Reactor II Mark-II metallic-driver-fuel element has been irradiated to high burnup to assess element lifetime and performance reliability. The purpose of this paper is to describe the irradiation performance of the Mark-II fuel element to 10 at.% burnup. Fission gas behavior, fuel deformation, fuel-cladding chemical interaction, fuel-cladding mechanical interaction, and cladding dilation are examined for their effect on Mark-II behavior. 27 refs.

56793 **Turbulent flow split model and supporting experiments for wire-wrapped core assemblies.** Chiu, C.; Todreas, N.E.; Rohsenow, W.M. (MIT, Cambridge, Mass). *Nuclear Technology;* **50**: No. 1, 40-52(Aug 1980).

A flow split model for the turbulent flow in a wire-wrapped nuclear fuel rod assembly is developed taking the form drag and sweeping flow between subchannels into consideration. This model is applicable to the flow distribution between two types of subchannels, i.e., interior and edge subchannels. 16 refs.

56794 **Liquid-metal fast breeder reactor vented assembly hydraulic modeling and testing.** Wang, J.C.F.; Dubberley, A.E. (Sandia Natl Lab, Livermore, Calif). *Nuclear Technology;* **49**: No. 2, 186-195(Jul 1980).

The principal difference between a conventional and vented assembly in a liquid-metal fast breeder reactor is that a vented assembly has holes cut in the duct wall at locations above the active core region and below the load pads above the core. The purpose of the vent holes is to allow coolant to leave the assembly and partially pressurize the interstitial spaces between the assemblies before exiting to the upper plenum through the load pads. A comprehensive analysis and hydraulic test verification were conducted to characterize the key flow coefficients that affect the design and evaluation of the vented core concept. 3 refs.

56795 **Under-sodium viewing development for FFTF.** Hoitink, N.C.; Horn, J.E.; Michaels, T.E.; Sheen, E.M.; Yatabe, J.M. (Westinghouse Hanford Co, Richland, WA). pp 4.37-4.43 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Transducers were developed for use in molten sodium to 600/degree/C, and an electronic imaging system was designed to scan the top of the reactor core and display results. Feasibility of imaging surfaces which are off-normal to the sound beam has been established. 8 refs.

56796 **Sodium technology experience at EBR-II - 1976 to 1980.** Smith, C.R.F.; Osterhout, M.M.; Olson, W.H. (Argonne Natl Lab-West, Idaho Falls, ID). pp 6.1-6.9 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The run-beyond-cladding-breach program adds substantial quantities of radionuclides to the systems. Actions taken to reduce radioactivity in the primary systems are operation of the cover-gas cleanup system and cesium trap. New purity monitoring components are the analytical cold trap, cover-gas hydrogen meter, and segregated-iodine sodium sampler. 9 refs.

56797 **Compatibility of Fe-9Cr-Mo ferritic steels in a sodium environment.** Chopra, O.K.; Natesan, K.; Kassner, T.F. (Argonne Natl Lab, IL). pp 7.26-7.34 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Kinetics of carburization/decarburization of five commercial and two high-purity Fe-9Cr-1 to 2.5Mo ferritic steels have been determined at temperatures between 773 and 973 K. Carbon concentration-distance profiles were obtained as a function of exposure time, temperature, and carbon in sodium, and carburization/decarburization rate constants were evaluated. The Fe-9Cr-Mo steels are more resistant to carbon transfer than the low-alloy Fe-2 1/4Cr-1Mo steel. 10 refs.

56798 **Methods of sodium waste disposal.** Wolson, R.D.; McPheeters, C.C. (Argonne Natl Lab, IL). pp 8.20-8.26 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Sodium oxide particles were coated with molten sodium in a rotary-drum reactor. Oxygen reacts to form Na/sub 2/O. The Na/

sub 2/O product was used in making glass for radioactive waste disposal. 9 refs.

56799 **Sodium removal from an EBR-2 secondary sodium cold trap.** Washburn, R.A.; Jacob, D.F. (Argonne Natl Lab, Idaho Falls, Idaho). pp 8.27-8.34 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A mesh-type cold trap was drained and washed with ethanol. Secondary sodium in the cold trap contained tritium; it was necessary to take radiation control measures during refurbishment. 1 ref.

56800 **Recent advances in the cleaning of large heat exchanging components by vacuum distillation of sodium.** van Melle, A.; Mulder, W.; Meijer, G.J.A.M. (TNO, Hengelo, Neth). pp 8.35-8.42 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

In 1978 and 1979 a 85 MW/sub th/ intermediate heat exchanger (IHX) was cleaned. This paper discusses making sodium plugs, transport of heat to the floating head, and cooling down after cleaning. 1 ref.

56801 **Sodium removal operations at WARD.** Simmons, C.R.; Haines, N.L. (Westinghouse Electr Corp, Madison, Pa). pp 8.43-8.48 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Water vapor/argon, Dowanol EB and water rinse processes have been used to remove residual sodium from loop test components. Process control parameters are reviewed.

56802 **Stress corrosion on austenitic stainless steels components after sodium draining.** Champeix, L.; Baque, P.; Chairat, C. (Cent d'Etud Nucl de Cadarache, Saint Paul Lez Durance, Fr). pp 8.49-8.55 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Damage study performed on 316 pipes of a loop after two leakages concluded that a stress corrosion process in sodium hydroxide environment has induced cracks. In aqueous sodium hydroxide, two corrosion processes are general oxidation increasing with aeration and transcrystalline cracking for stresses on the order of yield strength. 5 refs.

56803 **Recent developments in liquid metal component testing.** Tessier, M.J. (Energy Technol Eng Cent, Canoga Park, Calif). pp 9.1-9.8 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The paper highlights three programs: the CRBR valve test, the self-actuated shutdown system, and the sodium-water reaction test.

56804 **50-MW prototype of the NIRA/CNEN sodium heated steam generator.** Barberis, M.; Avanzini, P.G.; Casalini, P.; Salgo, G.; Manoni, A. (Nucl Ital React Avanzati, Genova, Italy). pp 9.20-9.28 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A sodium heated steam generator has been developed by CNEN and NIRA. Problems during construction are reported with emphasis on tube to tubesheet welding.

56805 **Effects of sodium-water testing and NDE of LMFBR-type steam generators.** Neely, H.H.; Freede, W.J. (Rockwell Int, Canoga Park, Calif). pp 9.29-9.34 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Results of testing have demonstrated phenomena related to test location: nominal steam tube wastage in the plane of rupture, deformation of steam tubes adjacent to the rupture, and sodium-water reaction product deposition in the lower portion of the steam generator impeding sodium flow. New NDE equipment was developed. 6 refs.

56806 **Experiences during testing of a prototype intermediate heat exchanger for SNR-300.** van Leeuwen, N.J.M.; Westerweele, W.J. (Neratoom, The Hague, Neth). pp 9.35-9.43 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Undesirable temperature differences in the tube bundle were caused by an unfavorable distribution of the primary flow and by heat input from a bypass flow. Modification produced the desired result. 5 refs.

56807 **Electromagnetic outlet temperature regulator for LMFBR breeder sub-assemblies.** Duncombe, E.; Thatcher, G. (UKAEA, Risley, Warrington, Engl). pp 9.44-9.51 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

An electromagnetic sodium flow break, energized by permanent magnets, incorporates in its magnetic circuit a NiFe alloy, selected for its Curie point which imparts a temperature-dependent braking function in the desired region. Outlet temperature variations due to burn-up are reduced by a factor of up to 3, virtually eliminating thermal striping. 5 refs.

56808 **New concept of electromagnetic pump suitable for secondary loops of sodium cooled reactors: theory and experiments.** Avanzini, P.G.; Barberis, M.; Monaci, R. (Nucl Ital Reatt Avanzati, Genova, Italy). pp 9.52-9.58 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A new electromagnetic pump which can be employed as the main cooling loops of sodium reactors is explained.

56809 **Large liquid metal primary shutdown system test rig design and operations experience.** Michael, H.D. (Westinghouse Electr Corp, Madison, Pa). pp 9.59-9.66 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The paper discusses a combined prototype and reliability test program formulated for liquid metal fast breeder reactor (LMFBR) primary shutdown systems.

56810 Design, construction and operation of a multibranch sodium test facility in support of LMFBR shutdown systems programs. Liszewski, C.L. (Westinghouse Electr Corp, Madison, Pa). pp 9.67-9.73 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The paper discusses the sodium loop system, automatic valve programming and sodium sampling system.

56811 Investigation of water leak self-evolution in sodium for sodium-water steam generators. Kozlov, F.A.; Sergeev, G.P.; Sednev, A.R.; Macarov, V.M. (Inst of Phys & Power Eng, Obninsk, USSR). pp 9.74-9.82 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

This paper presents results of experiments regarding small leaks of water vapor into sodium and damage of tubes made of steel 1*2M. 4 refs.

56812 Sodium tests on Super-Phenix prototypes and components. Fruchard, Y.; Sauvage, M.; Elie, X.; Depierre, Y. (Cent d'Etud Nucl de Cadarache, Saint Paul Lez Durance, Fr). pp 11.1-11.9 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

This paper gives a brief review of the sodium testing program.

56813 Construction, installation and sodium testing of a test section simulating the rotating parts of Super Phenix primary pump (pivoterie-1). Ghia, G.; Cela, V.; Casalini, P.; Mengoli, G.; Rappini, R. (Fabbrica Ital Automob Torino, Italy). pp 11.10-11.15 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A plant for testing sodium pumps and rotating parts is described.

56814 Testing of the subscale inducer pump at ETEC. McDowell, M.W.; Hoshide, R.K. (Energy Technol Eng Cent, Canoga Park, Calif). pp 11.16-11.23 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

An inducer is an axial pumping stage which raises the head of the liquid entering the impeller. Cavitation, performance mapping and endurance tests were conducted in water and sodium. 6 refs.

56815 Technological tests on LMFBR components at the Casaccia Center. Santandrea, E.; Diamanti, M. (CNEN, Rome, Italy). pp 11.24-11.31 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Experimental plants and sodium loops are being operated for out-of-pile testing of LMFBR components in operating conditions of the coolant. 5 refs.

56816 FFTF sodium and cover gas characterization and purification. McCown, J.J.; Bloom, G.R.; Meadows, G.E.; Mettler, G.W. (Westinghouse Hanford Co, Richland, Wash). pp 12.22-12.32 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The primary and secondary heat transport system sodium is purified with cold traps which have packed crystallizers and external economizers. The primary cold trap is NaK cooled and the secondary cold traps are air cooled. Sampling and analysis methods are presented, impurity excursions in the cover gas and sodium are described, and impurity trends are discussed. 9 refs.

56817 Mass transfer behaviour of steel materials in liquid sodium further studies in support of the UK fast reactor programme. Thorley, A.W.; Tyzack, C.; Blundell, A.; Raine, A.C. (UKAEA, Risley, Warrington, Engl). pp 13.1-13.11 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Studies have provided corrosion data for modeling mass transfer behavior of steels used in fast reactor circuits, assess the effect of selective loss of alloying and interstitial elements on metallurgical structure and study the deposition behavior of inactive and radioactive corrosion products. 14 refs.

56818 Radioactive and non-radioactive mass transport in a mockup loop of the LMFBR primary heat transfer system. Menken, G.; Quandt, U.; Ebberink, J. (INTERATOM, Bergisch Gladbach, Ger). pp 13.12-13.19 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Mass transfer of stainless steel alloying elements including interstitial elements was determined. Transfer of activated corrosion products Co 60, Mn 54 and fission products Cs 137/134 was measured. 2 refs.

56819 Corrosion and mass transfer in the Ml-1 sodium loop. Marin, A.; de la Torre, M.; Borgstedt, H.U. (Junta de Energ Nucl, Madrid, Spain). pp 13.20-13.26 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Carburizing and nitriding effects in Nb stabilized stainless steel penetrate the material in about 6000 h exposure time. The formation of a crystalline Cr/sub 2/N phase on the sodium corroded surface of different steels after air leakage into the system is another result. 4 refs.

56820 Mass transfer deposits in lithium-type 316 stainless steel thermal-convection loops. Tortorelli, P.F.; DeVan, J.H. (Oak Ridge Natl Lab, Tenn). pp 13.55-13.63 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The morphology and composition of deposits varied with loop operating time. Initially, chromium-rich dendritic crystals formed in the colder region. Later the deposits changed in structure and contained nickel and iron. Deposition rates were also measured as a function of time and temperature. 9 refs.

56821 **Intergranular penetration of 2/one quarter/Cr-1Mo weldments by a lithium-lead liquid.** Anderson, T.L.; Edwards, G.R.; Hoffman, N.J.; Lumsden, J.B. (Colo Sch of Mines, Golden). pp 13.64-13.72 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Penetration at prior austenitic grain boundaries was observed in the heat-affected zones of GTA-welded 2/one quarter/Cr-1Mo steel after the metal was exposed at 500C for short times to liquid lithium containing 17.6 wt% lead. Corrosion resistance was improved in weldments given a post-weld heat treatment to convert cementite to M/sub 23/C/sub 6/ and/or /epsilon/-carbide. Niobium-stabilized 2/one quarter/Cr-1Mo steel was resistant to intergranular attack. 15 refs.

56822 **Experiments on the corrosion of 316 stainless steel by liquid lithium.** Bauer, D.G.; Stewart, W.E.; Sviatoslavsky, I.N.; Sze, D.K. (Univ of Wis, Madison). pp 13.73-13.81 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A forced convection loop has been used to study long term corrosion at temperatures of 440 C and 490 C, temperature differences of 110 C to 195 C, and velocities of 40 cm/s to 130 cm/s. Fusion blankets using flowing liquid lithium at temperatures greater than 440 C will have difficulties with corrosion and redeposition. Fluid mechanics plays a major role in the corrosion process. 7 refs.

56823 **Sodium vapor-mist deposition on the surface of annular vertical gaps simulating shield plug.** Hashiguchi, K.; Hara, J.; Ugawa, Y.; Wagatsuma, K.; Nei, H. (Toshiba Corp, Jpn). pp 14.8-14.15 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Sodium vapor deposits on the surface of shield plugs then acts as a rotational drag force during fuel exchange. Three reducing methods were investigated. 11 refs.

56824 **Emissivity of sodium wetted and oxidized type 304 stainless steel.** Haines, N.L.; Craig, R.E.; Forsyth, D.R.; Novendstern, E.H. (Westinghouse Electr Corp, Madison, Pa). pp 14.23-14.29 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Emissivity was determined to provide data for calculating heat flow through LMFBR reflector plates to the reactor closure head. Emissivity ranged from 0.55 to 0.92. 2 refs.

56825 **Heat and mass transfer to the cooled roof and walls of a short air-filled cylinder from two concentric pools of water.** Ainsworth, R.W.; Hawtin, P.; Ralph, J.C.; Roberts, D.N. (AERE, Harwell, Oxfs, Engl). pp 14.30-14.37 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

This phenomenon has been studied using two concentric pools of water at differing temperatures confined by a cooled roof and approximately adiabatic walls. 5 refs.

56826 **Radionuclides in the cover gas of KNK II.** Stade, K.Ch.; Richard, H.; Hoffman, G.; Jacobi, S.; Schmitz, G. (Kernkraftwerk-Betriebseges, Eggenstein-Leopoldshafen, Ger). pp 14.38-14.45 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Measurements revealed deviation from a dependence between reactor power and the activity concentration of radionuclides in the primary cover gas. The profile of sodium flow rate through the core is different between the central zone and the surrounding driver zone. Gas bubbles entrained from the primary cover gas are transported through the core. 5 refs.

56827 **Operating experience with the EBR-II cover-gas-cleanup system.** Richardson, W.J.; Clark, A.F. (Argonne Natl Lab, Idaho Falls, Idaho). pp 14.46-14.53 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A cover-gas-cleanup system removes krypton, xenon and other condensable gases, using a cryogenic distillation process. Included is a continuous xenontag trapping and analysis system. 1 ref.

56828 **Detection and localization of a failed fuel bundle after full power operation of KNK II.** Richard, H.; Breitlaender, H.; Stade, K.Ch.; Schmidt-Hoenow, M.; Relic, M.; Dauk, J. (Kernkraftwerk-Betriebsges, Eggenstein-Leopolshafen, Ger). pp 14.54-14.58 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Signals from the cover gas system and DND monitors as well as an estimation of fission gas released into the reactor cover gas indicated subassembly defect. The paper describes localization tests.

56829 **Monitoring and control of impurities in sodium systems.** Haubold, W.; Jung, J.; Schillings, K.L. (INTERATOM, Bergisch Gladbach, Ger). pp 15.1-15.8 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The status of sampling methods, foil equilibration techniques, and hydrogen, oxygen, and carbon meter development is reported. The kinetics of sodium purification by cold trapping and hot gettering for the removal of oxygen and hydrogen impurities have been investigated. 12 refs.

56830 **Operating experience with on-line meters at Experimental Breeder Reactor-II (EBR-II).** Osterhout, M.M. (Argonne Natl Lab-West, Idaho Falls, Idaho). pp 15.9-15.15 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

On-line oxygen, hydrogen, and tritium meters are reliable diagnostic tools for monitoring the purity of sodium systems in an LMFBR. 4 refs.

56831 **Application of an electrochemical cell to hydrogen determination in cover gas and to leak detection in sodium-water steam generators.** Teske, K.; Richter, W.; Betzl, K.; Witke, W.; Priwalov, Ju.W.; Ledovskych, N.M.; Konjkov, W.F.; Romanov, G.I. (Cent Inst for Nucl Res, Rossendorf, E Ger). pp 15.16-15.20 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Results are presented on testing the measuring device Oxylyt. The hydrogen detector works on the basis of a solid electrolyte cell with coulometric titration of hydrogen in the gas stream. 2 refs.

56832 **Evaluation tests on water leak detection system of LMFBR steam generator system.** Tamayama, K.; Kosugi, T.; Daigo, Y.; Tsukiji, M. (Nucl Fuel Dev Corp, Ibaraki, Jpn). pp 15.21-15.28 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Tests for evaluating hydrogen behavior with the hydrogen injection method have been conducted to establish the water leak detection system applicable to the prototype plant MONJU.

56833 **Evaluation of hydrogen and oxygen meters in sodium as steam generator leak detectors.** McKee, J.M.; Smith, F.A.; Koehl, E.R. (Argonne Natl Lab, Ill). pp 15.29-15.36 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Steam-to-sodium leak detectors and calibration equipment are being tested in sodium circulating at 496/degree/C (925/degree/F) and 1.24 MPa (180 psi) with excursions to 2.24 MPa (325 psi). 10 refs.

56834 **Harwell carbon meter (HCM).** Asher, R.C.; Harper, D.C.; Kirstein, T.B.A. (UKAEA, Harwell, Oxfs, Engl). pp 15.46-15.53 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The Harwell carbon meter has been tested over a number of years as a reliable means of continuously determining the thermodynamic activity of carbon dissolved in liquid sodium in the laboratory, pilot scale loops or in-reactor sodium coolant circuits. 3 refs.

56835 **Measurement of carbon thermodynamic activity in circulating sodium circuits.** Kozlov, F.A.; Zagorulko, Ju.I.; Kovalev, Ju.P.; Alexeev, V.V. (Inst of Phys & Power Eng, Obninsk, USSR). pp 15.54-15.72 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Measurements of carbon activity in the sodium isothermic flow core and the channel near-wall region are investigated. 10 refs.

56836 **Experience in application of electrochemical cells for the determination of oxygen activity in sodium.** Ullmann, H.; Reetz, T.; Richter, W.; Lang, H.J.; Irmisch, R.; Naefe, H.; Betzl, K.; Boettger, A.; Nebelung, C.; Kozlov, F.A.; Kuznecov, E.K.; Worobjewa, T.A.; Piskunov, W.N.; Jefimov, J.A.; Tymosch, B.S.; Panitkov, W.T. (Cent Inst for Nucl Res, Rossendorf, E Ger). pp 16.1-16.8 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Experiments using X- and gamma-ray sources as well as examinations on the primary circuit of the reactor BR-10 (USSR) demonstrated qualification for continuous determination of oxygen activities. 16 refs.

56837 **Experience of the production, performance and application of Harwell oxygen meter tubes.** Thompson, R.; Taylor, G.R.; Asher, R.C.; Wheatley, C.C.H.; Dawson, R. (AERE, Harwell, Oxfs, Engl). pp 16.9-16.14 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The method used to produce yttria-doped-thoria tubes is outlined. The results of long-term testing as oxygen meters in sodium is described. 3 refs.

56838 **Continuous monitoring of oxygen activity in liquid sodium with an electrochemical oxygen sensor.** Licina, G.J.; Roy, P.; Nei, H.; Kakuta, A. (GE, San Jose, Calif). pp 16.15-16.21 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The accuracy, stability, durability, and response characteristics of the oxygen cell are described. 9 refs.

56839 **Sodium chemistry work at the Reactor Research Centre, Kalpakkam, India.** Mathews, C.K.; Bhat, N.P.; Periaswami, G. (React Res Cent, Kalpakkam, India). pp 16.22-16.29 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The paper outlines the analytical procedures used for impurity measurement and describes the analytical sodium chemistry loop, electrochemical carbon meter and experiments to measure the solubility of manganese in sodium. 11 refs.

56840 **Sodium chemistry at KNK-II.** Stamm, H.H.; Stade, K.Ch.; Richard, H. (Kernforschungszent Karlsruhe, Ger). pp 16.30-16.37 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Metals in the primary and secondary sodium were determined. Except for Zn, Ag, Sb and Co, the concentrations found were above the solubilities. Cold traps loaded with radioactive corrosion products were dismantled and a program for cleaning loaded cold traps was initiated. 12 refs.

56841 **Development of in-sodium electrochemical hydrogen and oxygen meters and their use in a study of the decomposition of sodium hydroxide in liquid sodium and in gettering reactions.** Whittingham, A.C.; Smith, C.A.; Simm, P.A.; Smith, R.J. (CEGB, Berkeley, Gloucestershire, Engl). pp 16.38-16.46 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Decomposition of sodium hydroxide in liquid sodium is relatively rapid, the half-life for the reaction increasing from 1 minute at 500/degree/C to 17 minutes at 300/degree/C. Observations are also presented on the kinetics of gettering of oxygen and hydrogen in solution by foils of uranium and yttrium in the temperature range 370-500/degree/C. 21 refs.

56842 **Developments in plugging meters and cold traps for LMFBRs.** Gwyther, J.R.; Hughes, G.; Simm, P.A.; Smith, C.A.; Whittingham, A.C.; Hebditch, D.J.; Saagi, R. (CEGB, Berkeley, Gloucestershire, Engl). pp 16.47-16.54 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Rates of change of orifice flow rate in an experimental plugging meter due to precipitation and dissolution of oxide and hydride have been measured and correlated with velocity in the orifice, concentration driving force and orifice temperature. Design schemes for cold traps are assessed theoretically for clean up rates and impurity capacities.

56843 **Investigation of plugging temperature indicator responses to oxygen and hydrogen impurity in sodium.** Itoh, K.; Takeda, K.; Nakasuji, T.; Yamamoto, K. (Power React & Nucl Fuel Dev Corp, Jpn). pp 16.55-16.62 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The behavior of plugging temperature indicators was studied. Mass transfer equations of these impurities were determined, and a method for identification of the deposits from precipitation and disolution kinetics is proposed. 7 refs.

56844 **EBR-II experience with frit-type plugging temperature indicators.** Olson, W.H.; Washburn, R.A. (Argonne Natl Lab, Idaho Falls, Idaho). pp 16.63-16.68 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A frit-type plugging temperature indicator is a sensitive device for measuring plugging temperatures in the primary and secondary sodium systems. Slow-plugging material plugs in the range of 170 - 180/degree/C and is unidentified. The fast-plugging material plugs in the range of 120 - 140/degree/C and correlates with sodium hydride saturation temperature.

56845 **Equipment for BN-600 reactor primary coolant sampling and analysis.** Arkhipov, V.M.; Arutyunov, K.M.; Karpov, A.V.; Kuznetsov, E.K.; Konovalov, E.E.; Kochetkov, L.A.; Lastov, A.I.; Matveev, V.P.; Matyukhin, V.V.; Orlov, V.I.; Tymosh, B.S.; Khoteev, N.V. (Inst of Phys & Power Eng, Obninsk, USSR). pp 16.69-16.75 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The carbon detection method is used for sampling and analysis of radioactive sodium coolant in primary circuits. 3 refs.

56846 **Studies of radioactive corrosion product release and deposition in the Harwell active mass transfer loop.** Newson, I.H.; Claxton, K.T.; Dawson, R.W.; Hawtin, P. (AERE, Harwell, Oxfs, Engl). pp 17.11-17.20 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The release and deposition of corrosion products from an irradiated stainless steel specimen has been studied. Along with inactive specimens of pure iron and nickel in sodium flowing at 6.1 m/s and 585/degree/C. 11 refs.

56847 **Radioactive materials transport analysis of the sodium inpile loop.** Sakai, T.; Ono, K.; Fukushima, K.; Miyaji, N.; Hirano, K.; Mitsutsuka, N. (Toshiba Corp, Kawasaki, Jpn). pp 17.21-17.28 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Deposition of Zr/Nb-95, Ru-103/106 and Ce-141/144 showed a downstream effect. For Cs-137 and Co-60, higher deposition densities were measured at cooler and heater positions. The corrosion rate at the irradiation section was estimated to be 3.9*10/sup -5/ cm/year. A difference in leaching rates was observed between Co-60 and Mn-54. Radionuclides distribution patterns along the loop were analyzed. Sticking coefficients were determined. 6 refs.

56848 **Release of fission products and fuel from defected fuel pins in sodium loops.** Feuerstein, H.; Stamm, H.H. (Kernforschungszent Karlsruhe, Ger). pp 17.29-17.35 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The release fractions and mechanisms from the fuel depended on the chemical element and on the half life of the nuclides. Most of the fission products and the released fuel were firmly fixed on the system surfaces. Over the surface a layer of Na/sub x/ (U, Pu) O/sub y/ was formed, causing swelling of the fuel pin and enlargement of the defects. 7 refs.

56849 **Transport analysis of short-lived fission products in sodium coolant.** Fukushima, K.; Handa, N.; Miyaji, N.; Aizawa, K. (Toshiba Corp, Kawasaki, Jpn). pp 17.36-17.43 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A computer code was developed for analyzing transport of short-lived fission products released from a failed fuel in the sodium coolant. For example, the transport analysis was performed for a 100 mw(t) LMFBR. 5 refs.

56850 **Behavior of fission products in an inpile sodium loop.** Feuerstein, H.; Mitsutsuka, N.; Sakai, T.; Fukushima, K.; Shimojima, H. (Kernforschungszent Karlsruhe, Ger). pp 17.44-17.50 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Deposition of bromine and iodine on stainless steel is a fast process; the equilibrium is attained within seconds. From clean sodium, tellurium is deposited by physical adsorption. The influence of larger amounts of sodium oxide on cold trapping of I-131, Cs-137 and Te-132 was investigated. 6 refs.

56851 Fuel pin operation in liquid sodium. Mayer, H.; Plitz, H.; de Heering, D. (INTERATOM, Bergisch Gladbach, Ger). pp 17.51-17.57 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

In a short time a cladding crack will develop into a wide crack with fuel-coolant contact. Fuel release will be governed by the formation of a protective sodium-uranate/plutonate layer, the formation of which is determined by the oxygen level within the fuel. 9 refs.

56852 Removal of radionuclides from liquid sodium by sorption on metallic surfaces. Stamm, H.H.; Hanke, H.D.; Clauss, H. (Kernforschungszent Karlsruhe, Ger). pp 17.58-17.66 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Among twenty materials tested, nickel was the only one qualified for the construction of a radionuclide trap aimed at removal of Zn-65, Mn-54, Co-58 and Co-60 from the primary coolant of a sodium cooled reactor. Due to an increased diffusion rate into the base metal, increased deposition of Zn-65 and Mn-54 on Ni was observed at 50 hours exposure time. Turbulence promotes deposition from flowing sodium. Nickel Pall rings are suited as packing. 13 refs.

56853 Fission-product removal from sodium by distillation. Misra, B.; McPheeters, C.C.; Wolson, R.D. (Argonne Natl Lab, Ill). pp 17.67-17.75 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The results of tests of a 100-mm-dia packed column having an equivalent of six theoretical stages and using /sup 133/Ba and /sup 137/Cs as the radioactive contaminants in sodium show that decontamination factors (ratio of /sup 137/Cs concentration in the distillate to the feed) exceeding 100 can be achieved. 5 refs.

56854 Chemical reactions in liquid lithium. Pulham, R.J.; Hubberstey, P.; Thunder, A.E.; Harper, A.; Dadd, A.T. (Univ of Nottingham, Engl). pp 18.1-18.8 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Solubility of N, H, D, Si and Ge has been determined. Cryoscopy discloses eutectics for N, H and D solutions, and all five solutes are more soluble in lithium than in liquid sodium. The outstanding difference from sodium is the ability of lithium to form and dissolve a nitride which is reactive towards both non-metals and transition metals. Though neither Li/sub 3/N nor Li/sub 2/C/sub 2/ react with LiH in lithium, reaction between Li/sub 3/N and Li/sub 2/C/sub 2/ occurs at 400/degree/C to form Li/sub 2/NCN which has been characterized by X-ray diffraction. Similarly Li/sub 3/N reacts with Si in lithium but not with Ge. Relevance to fusion reactors is discussed. 12 refs.

56855 Thermochemistry in the system Li-O-H, Li-O-C, Li-N-C. Migge, H. (Hahn-Meitner-Inst fuer Kernforschung, Berlin, Ger). pp 18.9-18.17 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Thermochemical analyses in the temperature range 500 K - 1500 K are made in the systems Li-O-H, Li-O-C, and Li-N-C, which are related to corrosion by impure liquid Li in a fusion reactor blanket. 29 refs.

56856 Reaction of chromium with lithium nitride in liquid lithium. Calaway, W.F. (Argonne Natl Lab, Ill). pp 18.18-18.26 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The study of the Li-N-Cr system is a step towards understanding corrosion of stainless steel by liquid lithium. The results appear to be inconsistent with the formation of Cr/sub 2/N, and it is proposed that a Li-Cr/sub 2/N, and it is proposed that a Li-Cr-N ternary compound is forming.

56857 Stabilities of salts of heteronuclear polyatomic anions towards liquid lithium. Hubberstey, P.; Harper, A.; Dadd, A.T.; Knight, D.J.; Naughan, K. (Nottingham Univ, Engl). pp 18.27-18.33 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Electrical resistivity techniques have been used to study the stabilities of various salts of heteronuclear polyatomic anions (i.e. LiNH/sub 2/, LiNO/sub 3/, NaHNCN and LiHCN/sub 4/) towards liquid lithium. The stability of Li/sub 2/NCN and its relevance to lithium technology is discussed. 13 refs.

56858 Auger electron spectra of lithium compounds. Schowengerdt, F.D.; Forrest, J.S. (Colo Sch of Mines, Golden). pp 18.34-18.40 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Auger Electron Spectra have been measured for lithium compounds in the form of powders and in corrosion regions of stainless steel. 6 refs.

56859 Stability of ternary oxides in liquid sodium and the formation of refractory metal nitrides and carbides in liquid lithium. Barker, M.G.; Fairhall, G.A.; Frankham, S.A. (Univ of Nottingham, Engl). pp 18.41-18.46 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The compounds MnO, NaMnO/sub 2/ and Na/sub 4/Mn/sub 2/O/sub 5/ are stable towards liquid sodium at different oxygen levels. In the cobalt system, no ternary oxides were stable at 650/degree/C, irrespective of the oxygen level. The formation of ternary oxides is restricted to lanthanide elements in the absence of dissolved nitrogen. 9 refs.

56860 Chemical and technological aspects of carbon in liquid sodium. Hobdell, M.R.; Trevillion, E.A.; Whittingham, A.C (CEGB, Berkeley, Gloucestershire, Engl). pp 18.47-18.53 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The reaction of liquid sodium with mineral oil has been studied. The reaction products include hydrogen, methane, and dissolved carbon. Attention is drawn to the relevance for detecting oil ingress in fast reactor sodium coolant circuits. The variation of sodium carbon activity with carbon content has also been investigated. 6 refs.

56861 **Solubility of metals, iron and manganese in sodium.** Stanaway, W.P.; Thompson, R. (AERE, Harwell, Oxfs, Engl). pp 18.54-18.61 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The solubility of iron in low oxygen sodium (uranium gettered) has been measured over the temperature range 385 to 724/degree/C. Preliminary results are presented on the solubility of manganese. 9 refs.

56862 **High-cycle fatigue results for type 304 stainless steel at 593/degree/C in flowing sodium.** Flagella, P.N.; Leasure, R.A. (Westinghouse Electr Corp, Madison, Pa). pp 19.26-19.32 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Sodium pre-exposure followed by fatigue testing does not effect the endurance limit of Type 304 stainless steel at 593/degree/C. 4 refs.

56863 **Influence of flowing sodium on the creep rupture and fatigue behaviour of type 304 SS at 550/degree/C.** Huthmann, H.; Menken, G.; Borgstedt, H.U.; Tas, H. (INTERATOM, Bergisch Gladbach, Ger). pp 19.33-19.40 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

In air the low-cycle fatigue life in the strain range from about 1.5 to 0.4% is increased. A slight decrease in rupture time occurs. In sodium with lead and tin impurities a decrease in rupture strength was determined for Type 304 but not for Type 316. 7 refs.

56864 **Creep-rupture and low-cycle fatigue behavior of types 304 and 316 stainless steel exposed to a sodium environment.** Natesan, K.; Chopra, O.K.; Kassner, T.F. (Argonne Natl Lab, Ill). pp 19.41-19.49 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Austenitic stainless steels for structural components, piping, valves, and the intermediate heat exchanger in LMFBRs are exposed to sodium at elevated temperatures and subjected to complex stress conditions. Recent information on uniaxial creep-rupture and low-cycle fatigue properties is evaluated. 13 refs.

56865 **Materials compatibility with liquid lithium.** Knovicka, H.R.; Sattler, P.F.; Schreinlechner, I.E. (Oesterr Studienges fuer Atomenerg Ges, Vienna, Austria). pp 19.65-19.69 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The first results of experiments at 650/degree/C on 316 SS show a slight weight gain in SS samples together with a reduction of the nitrogen level in Li. The samples show more embrittlement under Li than after heat treatment at 650/degree/C in Ar cover gas. The application of analytical techniques for determination of trace impurities in sodium to lithium is discussed. 6 refs.

56866 **Recent advances in lithium processing technology at the Argonne National Laboratory.** Weston, J.R.; Calaway, W.F.; Yonco, R.M.; Maroni, V.A. (Argonne Natl Lab, Ill). pp 20.1-20.8 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Methods for controlling and monitoring impurities in lithium loop systems have been evaluated. A method based on molten-salt extraction coupled with electrolysis of the salt phase has the potential for reducing nitrogen, carbon, and hydrogen levels to the <10 appm range. Electrical resistance- and hydrogen-permeation-type impurity meters have adequate sensitivity for hydrogen and nitrogen monitoring at levels down to and possibly below 100 appm. 11 refs.

56867 **Lithium aerosol formation in relation to fusion reactors.** Down, M.G.; Bauerle, J.E.; Whitlow, G.A. (Westinghouse Electr Corp, Pittsburgh, Pa). pp 20.16-20.23 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Results are presented concerning the magnitude of lithium aerosol formation in helium and argon atmosphere as well as under partial vacuum conditions. The impact such aerosols will have on the use of lithium in fusion power reactor technology is discussed, and note is made of the effect of sodium impurities. 14 refs.

56868 **On-line impurity monitors as applied to a study of cold trapping in liquid lithium.** Calaway, W.F.; Weston, J.R.; Van Deventer, E.H.; Maroni, V.A. (Argonne Natl Lab, Ill). pp 20.24-20.32 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A resistivity impurity meter and a permeation-type hydrogen meter employing a Nb-1 Zr membrane were installed. Hydrogen isotope (H and D) and nitrogen concentrations of $less than equivalent to$100 appm in liquid lithium can be continuously monitored. 20 refs.

56869 **Testing of a meshless cold trap for hydrogen removal from sodium.** Eichelberger, R.L. (Rockwell Int, Canoga Park, Calif). pp 20.33-20.38 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Cold trap performance conformed to an empirical model for hydrogen removal during trapping of the first 75% of the hydrogen removed. 1 ref.

56870 **Cold trap modeling and experiments on NaH precipitation.** McPheeters, C.C.; Raue, D.J. (Argonne Natl Lab, Ill). pp 20.39-20.47 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

A computer model is being developed to optimize cold trap design for hydrogen capacity. Hydrogen mass transfer coefficients ranging upward from 6*10/sup -5/ m/s were measured. The rate of mass transfer and the efficiency of the trap increased with increasing quantities of NaH deposited. 14 refs.

56871 **Upgrade of Westinghouse Steam Generator Facility (GPL-1/SWL-2) to 2.0 megawatt.** Schmidt, D.K. (Westinghouse Electr Corp, Madison, Pa). pp 21.31-21.38 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Operational planning for the liquid metal fast breeder reactor (LMFBR) double wall few-tube steam generator test program is outlined.

56872 **New approach in defining design failures of LMFBR steam generators.** Dumm, K.G. (INTERATOM, Bergisch-Bladbach, Ger). pp 21.39-21.44 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Based on the assumption that a tube failure propagation accident is the most likely one, design failures should be defined as a multiple of the lowest leak rate which is sufficient to activate the rupture discs dynamically. 4 refs.

56873 **Electromagnetic pumps (HALIPS) for high temperature active sodium circuits.** Davidson, D.F.; Mitchell, J.; Thomson, A. (UKAEA, Warrington, England). pp 21.50-21.55 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The Helical Annular Linear Induction Pump (HALIP) is a 3-phase electromagnetic pump for use up to 600°C without external cooling. 6 refs.

56874 **Transient test facility for LMFBR subassembly instrumentation.** Pugh, H.; Clare, A. (UKAEA, Warrington, England). pp 21.56-21.63 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The facility has been used for evaluating the dynamic performance of a subassembly instrument package of thermocouples and flowmeters. 4 refs.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

56875 **Rotating ned reactor as a power source for em gun applications.** Powell, J.; Botts, T.; Stickley, C.M.; Meth, S. (Brookhaven Natl Lab, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-18**: No. 1, 135-144(Jan 1982). (CONF-801138—).

From Electromagnetic guns and launchers conference; San Diego, CA, USA (4 Nov 1980).

Electromagnetic gun applications of the Rotating Bed Reactor (RBR) are examined. The RBR is a compact (approximately 1 m/sup 3/), (up to several thousand MW(th), high-power reactor concept, capable of producing a high-temperature (up to approximately 3000/degree/K) gas stream with a MHD generator coupled to it. The RBR can generate electric power (up to approximately 1000 MW(e)) in the pulsed or cw modes. Three EM gun applications are investigated: a rail gun thruster for orbit transfer, a rapid-fire EM gun for point defense, and a direct ground-to-space launch. The RBR appears suitable for all applications. 4 refs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 56411, 56756

56876 (INIS-mf—7092, pp vp) **Environmental impact of nuclear power plant - draft report for licensing.** Marek, J.; Konecny, J. (Ceske Energeticke Zavody, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The draft report for licensing procedures is described which should include: 1) a justification of the need of an energy source in the given area, 2) a description of the nuclear power plant, 3) the sources of pollution, 4) the ecological aspects of preparation and construction, 5) the ecological aspects of operation of the nuclear power plant, 6) the description of other sources of pollution in the larger environment and possible interference with the nuclear power plant, 7) the uses of the nuclear plant, 8) a cost benefit analysis. The thus compiled report would present a comprehensive picture of the environmental impact of the nuclear power plant and would evaluate all aspects.

56877 **(NUREG—0325-REV-4) U.S. Nuclear Regulatory Commission functional organization charts.** (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1982. 58p. NTIS, PC A04/MF A01.

Functional organization charts for the NRC Commission Offices, Divisions, Staffs and Branches are presented.

56878 **(NUREG—0452-REV-4) Standard technical specifications for Westinghouse pressurized water reactors (revision issued Fall 1981). Technical report.** Virgilio, M.J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1981. 564p. NTIS, PC A24/MF A01.

The Standard Technical Specifications for Westinghouse Pressurized Water Reactors (W-STS) is a generic document prepared by the U.S. NRC for use in the licensing process of current Westinghouse Pressurized Water Reactors. The W-STS sets forth the Limits, Operating Conditions and other requirements applicable to nuclear reactor facility operation as set forth in Section 50.36 of 10 CFR Part 50 for the protection of the health and safety of the public.

56879 **(NUREG—0485-Vol.4-No.7) Systematic evaluation program. Status summary report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). 31 Jul 1982. 94p. NTIS - GPO.

Portions of document are illegible.

Correspondence activities are listed that are related to the licensing of the Big Rock Point reactor; Dresden-1 reactor; Dresden-2 reactor; Ginna-1 reactor; Connecticut Yankee reactor; LACBWR reactor; Millstone-1 reactor; Oyster Creek-1 reactor; Palisades-1 reactor; San Onofre-1 reactor; and Rowe Yankee reactor.

56880 **(NUREG—0566-V1-N10) Standards development status. Summary report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Dec 1981. 229p. NTIS, PC A11/MF A01.

The Standards Development Status Summary Report is designed for scheduling, monitoring, and controlling the process by which Regulatory Standards, Guides, Reports, Petitions, and Environmental Statements are written. It is a summary of the current schedule plans for development of the above products.

56881 **(NUREG—0566-V2-N1) Standards development status summary report: data as of December 31, 1981 and January 31, 1982.** (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1982. 206p. NTIS, PC A10/MF A01.

The Standards Development Status Summary Report is designed for scheduling, monitoring, and controlling the process by which Regulatory Standards, Guides, Reports, Petitions, and Environmental Statements are written. It is a summary of the current schedule plans for development of the above products.

56882 **(NUREG—0652-V1-N3) Facilities license application record: data as of December 31, 1981. Tri-annual report 1 Oct 81-31 Dec 81.** (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1982. 49p. NTIS, PC A03/MF A01.

The FLAR is divided into three parts as follows: The first part is a listing of all operating licenses, authorizations, and construction permits in effect plus applications pending; The second part is a listing of applications that have been withdrawn or denied, and licenses and construction permits terminated or revoked; The third part is a listing of research, test, and power reactors for export.

56883 (NUREG—0659) Staff supplement to the draft report on human engineering guide to control room evaluation: response to comments, sample checklist, draft systems review guidelines, and evaluation procedures. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Mar 1981. 359p. NTIS, PC A16/MF A01.

This staff supplement to Draft Report NUREG/CR-1580, Human Engineering Guide to Control Room Evaluation, provides staff responses to comments on the draft report and supplemental material not provided in the draft report. The supplemental material includes new draft guidelines for the systems review of nuclear power plant control rooms and sample checklists and corresponding human engineering guidelines.

56884 (NUREG—0718-Rev-2) Licensing requirements for pending applications for construction permits and manufacturing license. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jan 1982. 65p. NTIS, PC A04/MF A01.

The TMI-2 Action Plan, NUREG-0660, does not specifically address requirements for construction permit and manufacturing license applications. There are currently pending five construction permit applications for ten units with light water reactors and one manufacturing license application for eight floating nuclear plants. Staff review of these applications had been suspended since the TMI-2 accident pending the formulation of a policy to appropriately reflect the lessons learned from the accident. The Commission has approved a new rule (10 CFR 50.34(f)) which states the TMI-related requirements to be applied to these applications. NUREG-0718 Rev. 1 was issued, and has now been revised, to provide guidance that the NRC staff believes should be followed to account for the lessons learned from the TMI-2 accident. NUREG-0718 Rev. 2 is not a substitute for the regulations, and compliance is not a requirement. However, an approach or method different from the guidance contained herein will be accepted only if the substitute approach or method provides an equivalent basis for meeting the requirements.

56885 (NUREG—0750-V13) Indexes to Nuclear Regulatory Commission Issuances, January-March 1981. (Nuclear Regulatory Commission, Washington, DC (USA)). 1981. 46p. NTIS, PC A03/MF A01.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Appeal Panel (ALAB), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judge (ALJ), the Directors Denials (DD), and the Denials of Petitions of Rulemaking are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. Information elements common to the cases heard and ruled upon are: Case name (owners of facility), Full text reference (volume and pagination), Issuance number, Issues raised by appellants, Legal citations (cases, regulations, and statutes), Name of facility, Docket number, Subject matter of issues and/or rulings, Type of hearing (for construction permit, operating license, etc.), and Type of issuance (memorandum, order, decision, etc.).

56886 (NUREG—0750-V14-N2) Nuclear Regulatory Commission Issuances, August 1981. (Nuclear Regulatory Commission, Washington, DC (USA)). 1981. 303p. NTIS, PC A14/MF A01.

Contents include: Issuances of the Nuclear Regulatory Commission--Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit No. 1), Metropolitan Edison Company, et al. (Three Mile Island Nuclear Station, Unit 1), Westinghouse Electric Corp. (Export of LEU to the Philippines); Issuances of Atomic Safety and Licensing Appeal Boards--Duke Power Company (Amendment to Materials License SNM-1773--Transportation of Spent Fuel from Oconee Nuclear Station for Storage at McGuire Nuclear Station); Issuances of the Atomic Safety Licensing Boards--Commonwealth Edison Company (Byron Station, Units 1 and 2), Dairyland Power Cooperative (La Crosse Boiling Water Reactor, Operating License and Show Cause), Florida Power and Light Company (St. Lucie Plant, Unit No. 2), Florida Power and Light Company (Turkey Point Nuclear Generating, Units 3 and 4), Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1) Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), The Regents of the University of California (UCLA Research Reactor), The Toledo Edison Company, et al. (Davis-Besse Nuclear Power Station, Units 2 and 3: Terminiation of Proceedings); Issuances of the Directors Denial--Florida Power and Light Company (St. Lucie Plant, Unit No. 2).

56887 (NUREG—0750-V14-N3) Nuclear Regulatory Commission Issuances, September 1981. (Nuclear Regulatory Commission, Washington, DC (USA)). 1981. 204p. NTIS, PC A10/MF A01.

Contents include: Issuances of the Nuclear Regulatory Commission--Commonwealth Edison Company (Dresden Nuclear Power Station, Unit 1), Consolidated Edison Company of New York (Indian Point, Unit 2), Metropolitan Edison Company, et al. (Three Mile Island Nuclear Station, Unit 1), Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), Power Authority of the State of New York (Indian Point, Unit 3), Texas Utilities Generating Company, et al. (Comanche Peak Steam Electric Station, Units 1 and 2); Issuances of Atomic Safety and Licensing Appeal Boards--Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), Philadelphia Electric Company, et al. (Peach Bottom Atomic Power Statin, Units 2 and 3), Metropolitan Edison Company, et al. (Three Mile Island Nuclear Statin, Unit No. 2), Public Service Electric and Gas Company (Hope Creek Generating Station, Units 1 and 2), The Toledo Edison Company, et al. (Davis-Besse Nuclear Power Station, Units 2 and 3); Issuances of the Atomic Safety Licensing Boards--Cleveland Electric Illuminating Company, et al. (Perry Nuclear Power Plant, Units 1 and 2), Commonwealth Edison Company (Dresden Station, Units 2 and 3), Houston Lighting and Power Company (Allens Creek Nuclear Generating Station, Unit 1), Southern California Edison Company, et al. (San Onofre Nuclear Generating Station, Units 2 and 3), Texas Utilities Generating Company, et al. (Comanche Peak Steam Electric Station, Units 1 and 2), Texas Utilities Generating Company, et al.

56888 (NUREG—0750-V14-N4) Nuclear Regualtory Commission Issuances, October 1981. (Nuclear Regulatory Commission, Washington, DC (USA)). Oct 1981. 156p. NTIS, PC A08/MF A01.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors Denial (DD), and the Denial of Petitions for Rulemaking (DPRM).

56889 (NUREG—0750-V14-N5) Nuclear Regulatory Commission issuance, pages 933-1089. (Nuclear Regulatory Commission, Washington, DC (USA)). Nov 1981. 167p. NTIS, PC A08/MF A01.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors Denial (DD), and the Denial of Petitions for Rulemaking (DPRM).

56890 (NUREG—0750-Vol.14) Indexes to Nuclear Regulatory Commission issuances, July-September 1981. Index 1. (Nuclear Regulatory Commission, Washington, DC (USA)). 1981. 63p. NTIS, PC A04/MF A01 - GPO.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Appeal Panel (ALAB), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions of Rulemaking are presented in this document. These digests and indexes are intended to serve as a guide to the issuances.

56891 (NUREG—0750-Vol.14-No.6) Nuclear Regulatory Commission issuances. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Dec 1981. 728p. NTIS, PC A99/FM A01 - GPO.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DRPM).

56892 (NUREG—0750-Vol.15-No.3) Nuclear Regulatory Commission issuances. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Mar 1982. 329p. NTIS - GPO.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions For Rulemaking (DPRM). The summaries and headnotes preceding the opinions reported herein are not to be deemed a part of those opinions or to have any independent legal significance.

56893 (NUREG—0871-Vol.1-No.3) Summary information report. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jul 1982. 50p. NTIS - GPO.

The Summary Information Report (SIR) provides summary data concerning NRC and its licensees for general use by the Chairman, other Commissioners and Commission staff offices, the Executive Director for Operations, and the Office Directors. SIR is published quarterly by the Management Information Branch (49-27834) of the Office of Resource Management.

56894 (PB—82-169137) Indexes to Nuclear Regulatory Commission Issuances, July-December, 1979. (Nuclear Regulatory Commission, Washington, DC (USA)). 1979. 79p. (NTISUB/B—142-79/404). NTIS, PC A05/MF A01.

Issuances of the Atomic Safety and Licensing Board (ASLB), the Atomic Safety and Licensing Appeal Boards (ALAB), regulatory issuances of the Commission (CLI), and the Directors Denial (DD), for the period July through December 1979 appear in Nuclear Regulatory Commission Issuances, 10 NRC No. 1, Pages 1 - 140, through 10 NRC No. 6, Pages 733 - 870. Digests and indexes for these issuances are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. Information elements common to the cases heard and ruled upon are-- case name (owners of facility); name of facility, docket number; type of hearing (for construction permit, operating license, etc.); issues raised by appellants; issuance number; type of issuance (memorandum, order, decision, etc.); issuance pagination; legal citations (cases, regulations, and statutes); and subject matter of issues and/or rulings.

56895 (PB—82-169160) Indexes to Nuclear Regulatory Commission Issuances, January-June, 1979. (Nuclear Regulatory Commission, Washington, DC (USA)). 1979. 74p. (NTISUB/B—142-79/402). NTIS, PC A04/MF A01.

Issuances of the Atomic Safety and Licensing Board (ASLB), the Atomic Safety and Licensing Appeal Boards (ALAB), regulatory issuances of the Commission (CLI), and the Directors Denial (DD), for the period January through June 1979 appear in Nuclear Regulatory Commission Issuances, 9 NRC No. 1, Pages 1 - 105, through 9 NRC No. 6, Pages 673 - 760. Digests and indexes for these issuances are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. Information elements common to the cases heard and ruled upon are-- case name (owners of facility); name of facility, docket number; type of hearing (for construction permit, operating license, etc.); issues raised by appellants; issuance number; type of issuance (memorandum, order, decision, etc.); issuance pagination; legal citations (cases, regulations, and statutes); subject matter of issues and/or rulings.

56896 (PB—82-180035) Nuclear Regulatory Commission issuances: opinions and decisions of the Nuclear Regulatory Commission with selected orders, January 1, 1979-June 30, 1979. Volume 9, pages 1-760. (Nuclear Regulatory Commission, Washington, DC (USA)). 1979. 822p. NTIS, PC A99/MF A01.

This is the ninth volume of issuances (1 - 760) of the Nuclear Regulatory Commission and its Atomic Safety and Licensing Appeal Boards, Atomic Safety and Licensing Boards, and Administrative Law Judge. It covers the period from January 1, 1979 to June 30, 1979.

56897 (PB—82-180043) Nuclear Regulatory Commission Issuances: opinions and decisions of the Nuclear Regulatory Commission with selected orders, July 1, 1979-December 31, 1979. Volume 10, pages 1-870. (Nuclear Regulatory Commission, Washington, DC (USA)). 1979. 934p. NTIS, PC A99/MF E01.

This is the tenth volume of issuances (1 - 870) of the Nuclear Regulatory Commission and its Atomic Safety and Licensing Appeal Boards, Atomic Safety and Licensing Boards, and Administrative Law Judge. It covers the period from July 1, 1979 to December 31, 1979.

56898 (UCID—18689-Rev.1) Technical evaluation report (Revision 1) on the proposed design modifications and technical specification changes on grid voltage degradation for the Pilgrim Nuclear Power Station, Unit 1 (Docket No. 50-293). Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 20 Aug 1982. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01. Order Number DE82020733.

This report documents the technical evaluation of the proposed design modifications and Technical Specification changes for the protection of Class 1E equipment from grid voltage degradation for the Pilgrim Nuclear Power Station. The review criteria are based on several IEEE standards and the Code of Federal Regulations. The evaluation finds that the proposed design modifications and Technical Specification changes ensure that the Class 1E equipment will be protected from sustained voltage degradation.

56899 (UCID—19453) Technical evaluation report on the proposed design modifications and technical specification changes on grid voltage degradation for the Vermont Yankee Nuclear Power Station (Docket No. 50-271). Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 25 Aug 1982. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE82020465.

This report documents the technical evaluation of the proposed design modifications and Technical Specification changes for protection of Class 1E equipment from grid voltage degradation for the Vermont Yankee Nuclear Power Station. The review criteria are based on several IEEE standards and the Code of Federal Regulations. The evaluation finds that the proposed design modifications and Technical Specification changes will ensure that the Class 1E equipment will be automatically protected from sustained voltage degradation concurrent with an accident. For non-accident conditions, plant procedures and the availability of redundant systems (pending NTC acceptance ensure that if required, a safe shutdown of the plant could be obtained and maintained should the normally operating Class 1E equipment be lost under degraded grid conditions.

56900 (UCID—19454) Technical evaluation report on the adequacy of station electric distribution system voltages for the Surry Power Station, Units 1 and 2 (Docket Nos. 50-280, 50-281). Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 1 Sep 1982. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01. Order Number DE82020730.

This report documents the technical evaluation of the adequacy of the station electric distribution system voltages for the Surry Power Station, Units 1 and 2. The evaluation is to determine if the onsite distribution system in conjunction with the offsite power sources has sufficient capacity to automatically start and operate all Class 1E loads within the equipment voltage ratings under certain conditions established by the Nuclear Regulatory Commission. The analyses submitted demonstrate that the station's electric distribution system will supply adequate voltage to the Class 1E equipment under the worst case conditions analyzed.

56901 **(UCID—19455) Technical evaluation report on the proposed design modifications and technical specification changes on grid voltage degradation for the Surry Power Station, Units 1 and 2 (Docket Nos. 50-280, 50-281).** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 25 Aug 1982. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE82020731.

This report documents the technical evaluation of the proposed design modifications and Technical Specification changes for protection of the Class 1E equipment from grid voltage degradation for the Surry Power Station, Units 1 and 2. The review criteria are based on several IEEE standards and the Code of Federal Regulations. The evaluation finds that the proposed design modifications and Technical Specification changes will ensure that the Class 1E equipment will be protected from sustained voltage degradation.

56902 **(NE-M—1-3T-Rev.-8-82) Mild steel covered welding electrodes (ASME SFA-5.1 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 7p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers mild steel covered welding electrodes for nuclear and associated applications. Material shall conform to the requirements of ASME SFA-5.1; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56903 **(NE-M—2-6T-Rev.-8-82) Martensitic stainless steel (type 403) forgings (ASME SA-182 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 9p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers martensitic stainless steel (type 403 modified) forgings for nuclear and associated applications. Material shall conform to the applicable requirements of ASME SA-182 as modified by Code Case N4; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56904 **(NE-E—15-2NB-T-Rev.-8-82) Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 36p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard supplements the rules for the construction of nuclear components that are covered by Subsections NCA and NB of the 1980 Edition of the ASME Boiler and Pressure Vessel Code (the Code), Section III. When this standard is invoked or referenced, the applicable subsections of Section III of the Code are also invoked or referenced. The user is responsible for obtaining and applying the edition and revisions of this standard that supplement the edition and Addenda of the Code that are in legal effect at the time of use.

2108 Economics

REFER ALSO TO CITATION(S) 56286, 56756, 56757, 56758, 56991, 57072

56905 **(NUREG/CR—1755) Technology, safety and costs of decommissioning nuclear reactors at multiple-reactor stations.** Wittenbrock, N.G. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Jan 1982. 342p. NTIS, PC A15/MF A01.

Safety and cost information is developed for the conceptual decommissioning of large (1175-MWe) pressurized water reactors (PWR) and large (1155-MWe) boiling water reactors (BWR) at multiple-reactor stations. Three decommissioning alternatives are studied: DECON (immediate decontamination), SAFSTOR (safe storage followed by deferred decontamination), and ENTOMB (entombment). Safety and costs of decommissioning are estimated by determining the impact of probable features of multiple-reactor-station operation that are considered to be unavailable at a single-reactor station, and applying these estimated impacts to the decommissioning costs and radiation doses estimated in previous PWR and BWR decommissioning studies. The multiple-reactor-station features analyzed are: the use of interim onsite nuclear waste storage with later removal to an offsite waste disposal facility, the use of permanent onsite nuclear waste disposal, the dedication of the site to nuclear power generation, and the provision of centralized services.

56906 **(NUREG/CR—2370) Design, costs, and acceptability of an electric utility self-insurance pool for assuring the adequacy of funds for nuclear power plant decommissioning expense. Technical report.** Chernick, P.L.; Fairley, W.B.; Meyer, M.B.; Scharff, L.C. (Analysis and Inference, Inc., Boston, MA (USA)). Dec 1981. 179p. NTIS, PC A09/MF A01.

The Report summarizes a feasibility study of an electric utility self-insurance pool for assuring the adequacy of funds for nuclear power plant decommissioning expense. The feasibility study was comprised of three components: (1) the design of such a self-insurance pool; (2) the estimation of the expected costs of coverage for such a pool; and (3) the testing of the acceptability of such a pool to the electric utility study.

56907 **Quality control during construction of power plants.** Hartstern, R.F. (Gilbert Commonw, Jackson, Mich). *Journal of the Construction Division, Proceedings of the ASCE (American Society of Civil Engineers);* **108**: No. CO1, 55-62(Mar 1982).

This paper traces the background and examines the necessity for a program to control quality during the construction phase of a power plant. It also attempts to point out considerations for making these programs cost effective.

56908 **Aggregate gradings for nuclear concrete.** Paulson, K.L.; Wright, R.H. (Bechtel Power Corp, San Francisco, Calif). *Journal of the Construction Division, Proceedings of the ASCE (American Society of Civil Engineers);* **108**: No. CO1, 105-120(Mar 1982).

The paper provides insight into the changes which occur in coarse aggregate gradation as the material is moved from the point of production into the actual concrete, and considers whether indicated variations in gradation influence the concrete strength. The importance of proper statistical controls during the production of coarse aggregates and the necessity of proper sampling and testing techniques are analyzed. 6 refs.

56909 **Technical management discipline in the Clinch River Breeder Reactor Plant project.** Riley, D.R.; Self, W.R. (CRBRP, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society, Supplement;* **41**: 66(1982). (CONF-820307—).

From Topical meeting on engineering for nuclear plant construction, operation, and maintenance; Charleston, SC, USA (28 Mar 1982).

56910 **Guidelines for estimating nonfuel operation and maintenance costs for large steam-electric power plants.** Myers, M.L.; Fuller, L.C.; Bowers, H.I. (Oak Ridge National Lab., TN). *Transactions of the American Association of Cost Engineers;* 240-244(1978). (CONF-780710—).

From 22. American Association of Cost Engineers meeting; San Francisco, CA, USA (9 Jul 1978).

Studies at the Oak Ridge National Laboratory (ORNL) of operation and maintenance (O and M) costs of large steam electric power plants are sponsored by the US Department of Energy (DOE) as part of the on-going research and development planning activities. ORNL is concerned with the development and evaluation of technologies for the production and use of energy from conventional and new sources. Energy strategies are examined, nuclear and coal-fired plant power costs are compared, and advanced energy concepts are studied for the sponsoring organizations.

56911 Power-plant capital-cost estimating using the CONCEPT-5 computer code. Hudson, C.R.; Bowers, H.I. (Oak Ridge National Lab., TN). *Transactions of the American Association of Cost Engineers;* 279-283(1978). (CONF-780710—).

From 22. American Association of Cost Engineers meeting; San Francisco, CA, USA (9 Jul 1978).

The CONCEPT-5 computer code is a quick, flexible tool for producing conceptual capital cost estimates of nuclear and coal fired power plants. The code's flexibility allows user selection of parameters such as plant and cooling system type, unit size, number of units, location, construction dates, escalation rates, and interest rate during construction. As output, the code produces detailed and summary cost estimates as well as cash flow information. This paper provides a description of the code and its methodology, the input and output options available to the user, and specific capital cost estimates for nuclear and coal fired power plants as examples.

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 56711, 56771

56912 (DOE/ET/34034—T12) MRS reformer design and heat balance. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jan 1982. Contract AC03-80ET34034. 10p. NTIS, PC A02/MF A01. Order Number DE82008522.

Portions of document are illegible.

This memo presents the bases to define the modular reactor plant parameters, reformer design, heat balance, and plant performance. The key ground rules for the design of the process plant are, similar to those for the monolithic reactor plant, 55% reformer power split and 60% methane conversion so that a comparison of the two reactor concepts will be more appropriate. The selection of the steam-to-methane ratio is the key to the process definition. The sensitivity of reformer design to steam-methane ratios was performed to determine reformer design requirements. The reformer design study was based on a vertical linear reactor reformer arrangement with upflow. The performance of reformer plant was also assessed to estimate the economic impacts of steam-methane ratios on end product costs.

56913 (DOE/SF/02034—T44Vol.2) HTGR high temperature process heat design and cost status report. Volume II. Appendices. (Gas-Cooled Reactor Associates, La Jolla, CA (USA)). Dec 1981. Contract AC03-78SF02034. 296p. (GCRA—82-001-Vol.2). NTIS, PC A13/MF A01. Order Number DE82005493.

Portions of document are illegible.

Information is presented concerning the 850°C IDC reactor vessel; primary cooling system; secondary helium system; steam generator; heat cycle evaluations for the 850°C IDC plant; 950°C DC reactor vessel; 950°C DC steam generator; direct and indirect cycle reformers; methanation plant; thermochemical pipeline; methodology for screening candidate synfuel processes; ECCG process; project technical requirements; process gas explosion assessment; HTGR program economic guidelines; and vendor respones.

56914 (DOE/SF/02034—T44Vol.3) HTGR high temperature process heat design and cost status report. Volume III. Appendices. (Gas-Cooled Reactor Associates, La Jolla, CA (USA)). Dec 1981. Contract AC03-78SF02034. 159p. (GCRA—82-002-Vol.3). NTIS, PC A08/MF A01. Order Number DE82006835.

Portions of document are illegible.

Information on the HTGR process heat reactor is presented concerning engineering drawings; 850°C IDC list of major equipment; 950°C DC list of major equipment; and turbine plant line sizing data.

56915 (DOE/SF/02034—T78) High-Temperature Gas-Cooled Reactor Steam Cycle/Cogeneration Lead Project strategy plan. (Gas-Cooled Reactor Associates, La Jolla, CA (USA)). Mar 1982. Contract AC03-78SF02034. 45p. NTIS, PC A03/MF A01. Order Number DE82013318.

The strategy for developing the HTGR system and introducing it into the energy marketplace is based on using the most developed technology path to establish a HTGR-Steam Cycle/Cogeneration (SC/C) Lead Project. Given the status of the HTGR-SC/C technology, a Lead Plant could be completed and operational by the mid 1990s. While there is remaining design and technology development that must be accomplished to fulfill technical and licensing requirements for a Lead Project commitment, the major barriers to the realization a HTGR-SC/C Lead Project are institutional in nature, e.g. Project organization and management, vendor/supplier development, cost/risk sharing between the public and private sector, and Project financing. These problems are further exacerbated by the overall pervading issues of economic and regulatory instability that presently confront the utility and nuclear industries. This document addresses the major institutional issues associated with the HTGR-SC/C Lead Project and provides a starting point for discussions between prospective Lead Project participants toward the realization of such a Project.

56916 (GA-A—16746) HTGR nuclear heat source component design and experience. Peinado, C.O.; Wunderlich, R.G.; Simon, W.A. (General Atomic Co., San Diego, CA (USA)). May 1982. Contract AT03-76SF70046. 6p. (CONF-820915—2). NTIS (US Sales Only). Order Number DE82016250.

From BNES international conference on gas cooled reactors today; Bristol, UK (20 Sep 1982).

Portions of document are illegible.

The high-temperature gas-cooled reactor (HTGR) nuclear heat source components have been under design and development since the mid-1950's. Two power plants have been designed, constructed, and operated: the Peach Bottom Atomic Power Station and the Fort St. Vrain Nuclear Generating Station. Recently, development has focused on the primary system components for a 2240-MW(t) steam cycle HTGR capable of generating about 900 MW(e) electric power or alternately producing high-grade steam and cogenerating electric power. These components include the steam generators, core auxiliary heat exchangers, primary and auxiliary circulators, reactor internals, and thermal barrier system. A discussion of the design and operating experience of these components is included.

56917 (ORNL/TM—8191) Desalting seawater and brackish waters: 1981 cost update. Reed, S.A. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 50p. NTIS, PC A03/MF A01. Order Number DE82020482.

Portions of document are illegible.

This is the fourth in a series of desalting cost update reports. Cost data are reported for desalting seawater by various distillation systems and by reverse osmosis. Costs of desalting four brackish waters, representative of those found in the United States by both reverse osmosis and electrodialysis are also given. Cost data are presented parametrically as a function of energy cost and plant size. The cost of desalting seawater by distillation has increased by 40% during the past two years, while desalting by reverse osmosis has increased by about 36% during the same period. Brackish water desalting by reverse osmosis has only increased by about 12%, and brackish water desalting by electrodialysis is up by 40%. Again, the continued increase in energy costs has had a major impact on all desalination systems.

56918 (DOE/SF/02034—T64) High-temperature process heat 950°C DC vs. 850°C IDC baseline plant cost comparison. (Gas-Cooled Reactor Associates, La Jolla, CA (USA)). [nd]. Contract AC03-78SF02034. 23p. NTIS, PC A02/MF A01. Order Number DE82008551.

Portions of document are illegible.

This evaluation compares two configurations of the 1170 MWt HTGR-R: the 950°C direct cycle (DC) plant vs. the 850°C indirect cycle (IDC) baseline plant. The subject evaluation is comprised of the following attachments: bases and assumptions for the cost and economic evaluations; capital cost and economic evaluation; major design differences; major technical issues; and drawings, as listed, for both plants. Drawing C-5001 is a composite plot plan which highlights the differences between the two plants.

22 NUCLEAR REACTOR TECHNOLOGY

56919 (INIS-mf—6845) **Advances in mathematical methods for the solution of nuclear engineering problems. Volume 1. Proceedings.** (American Nuclear Society, La Grange Park, IL. Mathematics and Computation Div.; Kerntechnische Gesellschaft e.V., Bonn (Germany, F.R.); European Nuclear Society, Petit-Lancy (Switzerland)). 1981. 709p. (CONF-810415—Vol.1). NTIS (US Sales Only), PC A99/MF A01. Order Number DE82780739.

From ANS/ENS joint topical meeting on mathematical methods in nuclear engineering; Munich, F.R. Germany (27 Apr 1981).

A separate abstract was prepared for each item. (HDR)

56920 (INIS-mf—7132) **Twenty-five years of the Nuclear Research Institute. Proceedings of the scientific and technical conference.** Vesely, V. (ed.). (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1980. 201p. (In Czech). (CONF-8006241—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE82780733.

From Nuclear Research Institute scientific and technical conference; Prague, Czechoslovakia (5 Jun 1980).

Separate abstracts are presented for each of the conference papers included in the data base.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 56957

56921 (NUREG/CR—2517) **Effect of radiolytic gas on nuclear excursions in aqueous solutions. Thesis.** Forehand, H.M. Jr. (Arizona Univ., Tucson (USA). Dept. of Nuclear Engineering). Jan 1982. 109p. NTIS, PC A06/MF A01.

Thesis.

Although not intended to study the evolution of a solution nuclear criticality accident, the Kinetic Experiment on Water Boiler (KEWB) demonstrated the dependence of the nuclear excursion on parameters such as solution temperature and radiolytic gas. Similarly, the CRAC ('Consequences Radiologigues d'un Accident de Criticite') program results indicate the excursion was governed by parameters such as the solution addition rate, initial neutron population, solute concentration, and thermal and radiolytic gas feedback. The majority of the energy deposited in a fissile solution is by the fission fragments. Energy deposition causes an increase in temperature decreasing density and hence neutron leakage. A second feature is the decomposition of water molecules into H2 and O2 in the solution. Microbubbles are nucleated in the fissile solution by a localized thermal spike generated by a fission fragment. In a supersaturated solution the bubble will grow and produce negative feedback by increasing neutron leakage. Both an energy and a pressure model have been incorporated into a space-independent kinetic computer code, MACKIN, while the pressure model was also incorporated into a space-dependent code, AZPAD. The models have been successful in predicting the peak power, burst energy, and maximum system pressure for the first burst in both KEWB and CRAC experiments.

56922 (ORNL—5851) **Updated version of the DOT 4 one- and two-dimensional neutron/photon transport code.** Rhoades, W.A.; Childs, R.L. (Oak Ridge National Lab., TN (USA)). Jul 1982. Contract W-7405-ENG-26. 141p. NTIS, PC A07/MF A01. Order Number DE82019853.

DOT 4 is designed to allow very large transport problems to be solved on a wide range of computers and memory arrangements. Unusual flexibilty in both space-mesh and directional-quadrature specification is allowed. For example, the radial mesh in an R-Z problem can vary with axial position. The directional quadrature can vary with both space and energy group. Several features improve performance on both deep penetration and criticality problems. The program has been checked and used extensively.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 56800, 56801, 56802, 56803, 56804, 56805, 56806, 56807, 56808, 56809, 56810, 56811, 56812, 56813, 56814, 56815, 56816, 56817, 56818, 56819, 56820, 56821, 56822, 56823, 56824, 56825, 56828, 56829, 56830, 56831, 56832, 56833, 56834, 56835, 56836, 56837, 56838, 56839, 56840, 56841, 56842, 56843, 56844, 56845, 56846, 56847, 56848, 56849, 56850, 56851, 56852, 56853, 56854, 56855, 56856, 56857, 56858, 56859, 56860, 56861, 56862, 56863, 56864, 56865, 56866, 56867, 56868, 56869, 56870, 56871, 56872, 56873, 56904, 56991, 57312, 57368, 57369, 57413, 57414, 57415, 57416, 59061

56923 (EGG-M—00681) **Common cause failure rate estimates for diesel generators in nuclear power plants.** Steverson, J.A.; Atwood, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1981. Contract AC07-76ID01570. 8p. (CONF-810905—28). NTIS, PC A02/MF A01. Order Number DE82007343.

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

Common cause fault rates for diesel generators in nuclear power plants are estimated, using Licensee Event Reports for the years 1976 through 1978. The binomial failure rate method, used for obtaining the estimates, is briefly explained. Issues discussed include correct classification of common cause events, grouping of the events into homogeneous data subsets, and dealing with plant-to-plant variation.

56924 (INIS-mf—7093, pp vp) **Some topical problems in the manufacture of steels for reactor pressure vessels.** Kepka, M. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The manufacture is described of pressure vessel steels with low contents of harmful and trace elements, gases and non-metallic inclusions. The steels are made of pure charge raw materials in electric arc furnaces and refined outside of furnaces or using vacuum and reheating furnaces of the ASEA-SFK or FINKL-MOHR type. The chemical compositions of the individual steels being manufactured are shown. (J.B.).

56925 (INIS-mf—7093, pp vp) **Chemical nonhomogeneity of large forging ingots.** Barackova, L.; Kepka, M.; Matejovic, K. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The metallurgy is described of the manufacture of ingots of 135 tons in weight for reactor pressure vessels. The forging technology for the ingots features an increased metallurgical discard from the ingot bottom and a reduced discard from the ingot top, the boring away of the ingot centre with increased proportion of metallurgical inclusions along the ingot axis, no ramming or trepanning of the rough forgings, the application of calibration and drifting using two taper calibration drifts before finishing on mandrels. The chemical analysis of the steel showed good homogeneity of the chemical composition of the core except for carbon and sulfur levels. (J.B.).

56926 (INIS-mf—7093, pp vp) **Overlaying alloys for sealing surfaces of valves for primary circuits in nuclear power plants.** Smrkovsky, E. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The requirements are presented for cobalt-free overlaying alloys such as hardness, a low friction coefficient, resistance to rapid temperature changes, structural stability. Alloy E-C-1111 was tested for the said requirements. Its composition is C max. 0.11%, Mn 4.3-4.5%, Si 4.2-5.3%, Cr 17.0-19.0%, Ni 7.5-9.0%, Mo 5.0-5.8%, and Nb 0.9-1.2%. It was found to show acceptable technological and mechanical properties for operation. Overlaying up to an inner diameter of 40 mm can be done without pre-heating, large semi-products should be preheated to 500 to 550 degC. After overlaying to a certain height, heat treatment and capillary testing are necessary to check that the overlay does not show cracks. It is recommended that small inner diameter parts should be overlayed layer by layer.

56927 (INIS-mf—7093) **Steels and alloys for nuclear power: proceedings of symposium.** (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). 1979. 238p. (In Czech). (CONF-7909256—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE82780700.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

Individual items in scope for the data base were entered separately. (DLC)

56928 (NUREG/CR—1205-REV-1) **Data summaries of Licensee Event Reports of pumps at U.S. commercial nuclear power plants. Technical report, 1 January 1972-30 September 1980.** Trojovsky, M. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1982. 425p. (EGG-EA—5524). NTIS, PC A18/MF A01.

This report presents data summaries of Licensee Event Reports (LERs) of pumps at U.S. Commercial (light water reactor) nuclear power plants from January 1, 1972, through September 30, 1980. LERs are written reports filed with the NRC whenever certain failures or incidents occur concerning nuclear plant safety systems. The LERs are sorted according to plant, system, and human factors. The selected pump failures reported in the LERs are used to estimate gross standby and operating failure rates, in per-hour and per-demand units. An explanation and summary tables of all results are provided. In addition to the quantitative failure rate information, there is also considerable qualitative information tabulated to allow the user to make additional pump failure rate calculations or inferences. This revised report updates and supersedes the original January 1980 printing of NUREG/CR-1205.

56929 (NUREG/CR—2426) **Design charts for nonlinear systems with gap supports under impulse loads. Topical report 1 Oct 80-30 Sep 81.** Anderson, J.C.; Masri, S.F. (University of Southern California, Los Angeles (USA). Dept. of Civil Engineering). Jan 1982. 224p. NTIS, PC A10/MF A01.

Design charts representing the nonlinear dynamic response of a single degree of freedom oscillator to impulse load are developed. Nonlinearity may be due to either a gap support or material yield or a combination of the two. Five impulse shapes are considered. Examples are presented which illustrate the use in design applications. Dynamic systems having various combinations of material and geometric nonlinearity often occur in complex mechanical and structural systems which are subjected to extreme loads. Representative of this class of problems are the structures and components of nuclear power plants which are subjected to postulated impulsive loads as part of the design process.

56930 (STUDSVIK—82/1) **Effect of previous cold work on the irradiation hardening of Zircaloy at low neutron doses.** Pettersson, K. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82904566.

Tension specimens of Zircaloy at various cold work levels have been irradiated to relatively low fast neutron doses of up to $3.5.10^{23}$ n/m^2 ($E > 1$ MeV). The evaluation of the combined cold work and irradiation effects on the yield stress shows that the dose dependence of the yield stress can be described by an equation. This equation is also in excellent agreement with previous data at high neutron doses.

56931 (STUDSVIK-SD—81-82) **Implementation and use of FRANTIC for time dependent unavailability analysis.** Poern, K. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Jul 1981. 48p. (SKI-B—63-80). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702219.

The computer code FRANTIC, developed at NRC Probabilistic Analysis Branch for the analysis of timedependent system unavailability, has been implemented on Cyber 172 at Studsvik. The correctness of the implementation has been verified by a number of test cases which were enclosed in the code-package. This paper reviews the methodology established in FRANTIC and illustrates the applicability of the code by a case study concerning the unavailability of the auxiliary feedwater system in the Oskarshamn II reactor.

56932 (NE-M—2-19T-Rev.-8-82) **2-1/4%-chromium, 1%-molybdenum alloy steel tubesheet forgings (ASME SA-336 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 9p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers 2-1/4%-chromium, 1%-molybdenum alloy steel forgings for heat exchanger, and steam generator tubesheets for nuclear and associated applications. Material shall conform to the requirements of ASME SA-336, Grade F22A; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56933 (NE-M—1-17T-Rev.-8-82) **Bare carbon steel electrodes and fluxes for submerged arc welding (ASME SFA-5.17 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 8p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers bare carbon steel electrodes and fluxes for submerged arc welding in nuclear and associated applications. Material shall conform to the requirements of ASME SFA-5.17; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56934 (NE-M—2-20T-Rev.-8-82) **Nickel alloy forgings (ASME SB-564 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 10p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers nickel alloy forgings for nuclear and associated applications. Material shall conform to the requirements of ASME SB-564; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56935 (NE-M—1-4T-Rev.-8-82) **Low-alloy-steel-covered welding electrodes (ASME SFA-5.5 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 8p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers low alloy steel covered welding electrodes for nuclear and associated applications. Material shall conform to the requirements of ASME SFA-5.5; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56936 (NE-M—7-3T-Rev.-8-82) **Alloy steel bars and shapes (ASME SA-479 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Aug 1982. 12p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard covers alloy steel bars and shapes for nuclear and associated applications. Material shall conform to the requirements of ASME SA-479; to the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III, Article NB-2000; and to the additional requirements of this standard.

56937 **Regime map for direct contact condensation.** Chan, C.K.; Lee, C.K.B. (JPL, Pasadena, Calif). *International Journal of Multiphase Flow;* 8: No. 1, 11-20(Feb 1982).

Direct-contact condensation is studied by injecting steam downward through a pipe and out of the submerged end into a pool of subcooled. The motion of the steam/water interface is recorded by high-speed movies and systematically classified, based on the injection rate and the pool subcooling. The resulting regime map shows the existence of three main condensation modes as the injection rate is reduced. 8 refs.

56938 **Nuclear science symposium, 26th and symposium on nuclear power systems, 11th, San Francisco, CA, October 17-19, 1979, proceedings.** Kerns, C.R. New York, NY; IEEE (1980). 958p.

The paper covers the studies presented on nuclear science and nuclear power systems symposiums. The studies deal with nuclear radiation detectors, nuclear circuits and systems, space and medical instrumentation, as well as with environmental and reactor instrumentation. Data preprocessing and acquisition are discussed. Emphasis is placed on the engineered safety features of nuclear systems.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 56791, 56792, 56793, 56826, 56827, 56828

56939 **Ferrite measurement using the HFEF eddy-current cladding integrity tester.** Carlson, B.G.; Franklin, E.M.; Phipps, R.D. (ANL-Idaho, Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **38**: 710-712(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

56940 **Use of fuel thermocouple transient response for data verification and fuel rod modeling.** Lanning, D.D.; Barnes, B.O.; Scheffler, W.A. (Battelle, Pac Northwest Lab, Richland, Wash). *Nuclear Technology;* **50**: No. 1, 95-107(Aug 1980).

Various interacting mechanical and thermal processes operate in a fuel rod during irradiation. Fuel rod modeling codes are written to predict the outcome of these interactions. These two questions concern the statistical confidence limits on thermocouple data for fuel temperature, and an evaluation concerning comparison of data and code prediction. 7 refs.

2204 Control Systems

REFER ALSO TO CITATION(S) 56993

56941 (INIS-mf—7093, pp vp) **Cooling down to low temperatures as part of production technology for nuclear reactor control elements.** Peca, P.; Kopriva, S. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Plzen, Czechoslovakia (20 Sep 1979).

A brief description and a diagram are presented of equipment for subcooling of parts in the manufacture of nuclear reactor control elements. The equipment houses items of maximum dimensions of 500 mm dia x 200 mm and a maximum weight of 100 kg. The lowest achievable temperature is -196 degC while the maximum permissible temperature of an item to be cooled is 100 degC. (B.S.).

56942 **Reactor control rod timing system.** Wu, P.T. (to Department of Energy). US Patent 4,314,881. 9 Feb 1982. Filed date 18 Mar 1980. vp.

PAT-APPL-131303.

A fluid driven jet-edge whistle timing system for control rods of a nuclear reactor for producing real-time detection of the timing of each control rod in its scram operation. An important parameter in reactor safety, particularly for liquid metal fast breeder reactors (LMFBR), is the time deviation between the time the control rod is released and the time the rod actually reaches the down position. The whistle has a nearly pure tone signal with center frequency (Above 100 kHz) far above the frequency band in which the energy of the background noise is concentrated. Each control rod can be fitted with a whistle with a different frequency so that there is no ambiguity in differentiating the signal from each control rod.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 58127, 58186

56943 (INIS-mf—7092, pp vp) **Spread of emissions from nuclear power plants in atmosphere and environmental impacts.** Hladky, E. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The processes are described of the migration of radioactivity in nuclear power plants and their environment and the current state is described in Czechoslovakia and in CMEA countries. The main sources of radioactive products are fuel elements and activated products of corrosion of the primary circuit and the reactor core. The final level of radioactivity of the emissions is given by the efficiency of the capture of radionuclides by filters of ventilation systems. The operation of nuclear power plants has confirmed the negligible impact of radioactive emissions from these plants on the environment.

56944 (INIS-mf—7092, pp vp) **Disposal of radioactive wastes at the locality of the Bohunice nuclear power plant.** Seliga, M. (Slovenske Energeticke Podniky, Bratislava (Czechoslovakia)); Hladky, E. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)); Tomik, L. (Atomova Elektraren Bohunice, Jaslovske Bohunice (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The current state is described of the storage and disposal of radioactive wastes from nuclear power plants A-1, V-1 and V-2 in Jaslovske Bohunice, Czechoslovakia. The critical state is described existing at the A-1 power plant where tanks for low-level and medium-level liquid radioactive wastes and sludges are full as are spaces for the storage of solid wastes, and decontamination cannot be carried out even after mothballing. The removal of radioactive wastes from the V-1 and V-2 nuclear power plants is also not satisfactory. It has been decided to solve the technology of waste removal from the area of the Jaslovske Bohunice nuclear power plant by building a bituminization line with evaporators for liquid wastes and incinerators and presses for solid wastes. The processing of the said wastes will be financed within the V-2 nuclear power plant.

56945 **(NUREG—0921) Draft Environmental Statement related to the operation of Catawba Nuclear Station, Units 1 and 2. Docket Nos. 50-413 and 50-414, Duke Power Company, et al.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Aug 1982. 194p. GPO.

Portions of document are illegible.

This Draft Environmental Statement contains the second assessment of the environmental impact associated with the operation of the Catawba Nuclear Station, Units 1 and 2, pursuant to the National Environmental Policy Act of 1969 (NEPA) and 10 CFR 51, as amended, of the NRC regulations. This statement examines: the affected environment, environmental consequences and mitigating actions, and environmental and economic benefits and costs. Land use and terrestrial and aquatic-ecological impacts will be small. Operational impacts to historic and archeological sites will be negligible. The effects of routine operations, energy transmission, and periodic maintenance of rights-of-way and transmission facilities should not jeopardize any populations of endangered or threatened species. No significant impacts are anticipated from normal operational releases of radioactivity. The risk associated with accidental radiation exposure is very low. The net socioeconomic effects of the project will be beneficial. The action called for is the issuance of operating licenses for Catawba Nuclear Station, Units 1 and 2.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 56776, 56778, 56786, 56993, 56999, 57000, 57009

56946 **(AD-A—109727/8) Calculation of the neutron and gamma-ray environment in and around the AFRRI TRIGA reactor. Volume II. Final report, 5 May-31 December 1980.** Verbinski, V.V.; Cassapakis, C.G. (Science Applications, Inc., La Jolla, CA (USA)). 1 Jun 1981. 269p. (SAI—272-81-183RI-LJ). NTIS, PC A12/MF A01.

This document summarizes the neutron spectral measurements and the neutron and gamma-ray calculations for five different irradiation geometries commonly employed in biological and electronic 'radiation-damage' studies: free field in both ER1 and ER2 exposure rooms; behind a 2-inch lead wall and inside an exercise wheel; behind a 6-inch lead wall and inside a 2-inch lead cave; and at the center of a tissue-equivalent phantom located behind a 6-inch lead wall.

56947 **(BARC—1134) Research and development activities of the Neutron Physics Division, January 1980-December 1980.** Basu, T.K.; Bhakay-Tamhane, S. (ed.). (Bhabha Atomic Research Centre, Bombay (India)). 1981. 95p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82904606.

Portions of document are illegible.

The research and development activities of the Neutron Physics Division during the year under review were in the fields of critical and subcritical fission systems, the plasma focus device, applied neutron physics, neutron and x-ray crystallography, materials physics and seismology. The highlights of this work are summarized.

56948 **(ORNL/TM—8367) Oak Ridge Research Reactor quarterly report, October, November, and December 1981.** Hurt, S.S.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE82020481.

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The ORR operated at an average power level of 29.8 MW for 80.1% of the time during October, November, and December of 1981. The reactor was shut down on thirteen occasions, three of which were unscheduled. Reactor downtime needed for refueling and checks was normal; however, downtime needed for maintenance was greater than normal due to repairs to the reactor primary waterline and strainer. The reactor remained available for use 85.6% of the time. Maintenance activities, both mechanical and instrument, were essentially routine in nature with the exception of one Mechanical Design Change Memo. In-service inspection completed during the quarter included: (1) inspection of the ORR pool window, (2) visual inspection of the ORR primary coolant heat exchanger No. 3, (3) ORR primary coolant pipe inspection, and (4) examination of ORR primary coolant strainers and housing.

56949 **Critical experiments with concrete-reflected Fast Test Reactor fuel pins in water.** Bierman, S.R.; Durst, B.M.; Clayton, E.D.; Howes, B.W. (Battelle, Pac Northwest Lab, Richland, Wash). *Nuclear Technology;* **49**: No. 1, 40-46(Jun 1980).

Criticality benchmark-type data are obtained on four undermoderated FTR (Fast Test Reactor) fuel pin-water lattices with concrete reflection. The experiments were designed to serve as benchmarks for validating computer codes and nuclear data used in calculations of mixed plutonium and uranium systems. These particular experiments provide measurement data on concrete reflectors that can be used for checking not only "concrete cross sections"but also the computer modeling of systems involving concrete reflectors. 1 ref.

56950 **Control of oxygen, hydrogen, and tritium in sodium systems at Experimental Breeder Reactor II.** Osterhout, M.M. (Argonne Natl Lab, Idaho Falls, Idaho). *Nuclear Technology;* **49**: No. 1, 47-50(Jun 1980).

The source rates and steady-state concentrations have been measured for oxygen, hydrogen, and tritium impurities in the Experimental Breeder Reactor II (EBR-II) sodium systems. Source rate data, steady-state impurity levels, and cold trap effectiveness are reported in this paper. 9 refs.

56951 **In-reactor measurement of neutron absorber performance.** Hollenberg, G.W.; Jackson, J.L.; Basmajian, J.A. (Hanford Eng Dev Lab, Richland, Wash). *Nuclear Technology;* **49**: No. 1, 92-101(Jun 1980).

An instrumented absorber experiment in the Experimental Breeder Reactor-II and reported in this paper, yielded data on the helium release of boron carbide at exposures up to 53 *10/sup 20/ neutron captures/cm/sup 3/ and temperatures from 766 to 952/degree/C. Helium release results demonstrated a high rate of helium release initially, and a much lower rate at higher burnup levels. In addition, the experiment demonstrated the effectiveness of vents in releasing gas from a plenum during irradiation. 9 refs.

56952 **Development and irradiaton performance of uranium aluminide fuels in test reactors.** Beeston, J.M.; Hobbins, R.R.; Gibson, G.W.; Francis, W.C. (Edgerton, Germeshausen and Grier Inc, Idaho Falls, Idaho). *Nuclear Technology;* **49**: No. 1, 136-149(Jun 1980).

Uranium aluminide powder production, fuel plate fabrication development, and irradiaton performance of more than 1700 fuel elements during 10 yr of operational service at Idaho National Engineering Laboratory are discussed. The purpose of this paper is to describe the material and fabrication development, and review the irradiation performance of the uranium aluminide dispersion system during 10 yr of operational service at INEL. 36 refs.

2207 Plutonium And Isotope Production Reactors

56953 **(UNI-TR—8) Calculated effects of dissolved gases on the thermodynamic properties of Hanford N Reactor primary coolant.** Bechtold, D.B. (UNC Nuclear Industries, Inc., Richland, WA (USA)). 23 Jun 1982. Contract AC06-76RL01857. 153p. NTIS, PC A08/MF A01. Order Number DE82020787.

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It has been noted that for present and anticipated modes of operation the Hanford N-Reactor primary coolant may bear thermohydraulically significant amounts of dissolved hydrogen, nitrogen, and ammonia. To investigate this possibility, calculations were made of the specific volume and specific enthalpy of aqueous primary coolant from available data and reasonable approximations over the necessary ranges of temperature and pressure. A computer program which produces a steam table of these properties, as well as compositions, has been coded to provide tables of the bubble line, dew line, superheated-vapor - compressed liquid, and two phase-to-20% void regimes from 32°F to 630°F and from 14 psia to 2100 psia. This program will provide the tables for any inputted coolant composition of water with 0.01 to 200 ppM NH_3, 0.01 to 50 ppM H_2, and 0.01 to 150 ppM N_2, or so long as the mole fraction of water remains above 0.999. Alteration for other water chemistries is not difficult.

2208 Propulsion Reactors

REFER ALSO TO CITATION(S) 57771

2209 Reactor Safety

REFER ALSO TO CITATION(S) 56799, 56800, 56801, 56802, 58046, 58166

56954 **(RISLEY-Trans—3319) Sodium-water steam-generator safety problems and their solutions in the USSR.** Poplavskii, V.M.; Bagdasarov, Yu.E.; Kozlov, F.A.; Kochetkov, L.A.; Titov, V.F. (UKAEA Risley Nuclear Power Development Establishment). [nd]. Translation of IAEA-SM-225/66. (CONF-780407—14-Trans.). 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82906191.

From Symposium on design, construction and operating experience of demonstration liquid metal fast breeder reactors; Bologna, Italy (10 Apr 1978).

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The paper gives the main results of experimental and mathematical theoretical investigations into emergency conditions resulting from the interaction of sodium and water, and also sets out the approach being taken in the USSR to safety problems with sodium-water steam generators with single-wall separation of coolants.

56955 (BNL-NUREG—31557) **Formation and characterization of fission-product aerosols under postulated HTGR accident conditions.** Tang, I.N.; Munkelwitz, H.R. (Brookhaven National Lab., Upton, NY (USA)). Jul 1982. Contract AC02-76CH00016. 10p. (CONF-820833—7). NTIS, PC A02/MF A01. Order Number DE82019448.

From 17. DOE nuclear air cleaning conference; Denver, CO, USA (1 Aug 1982).

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The paper presents the results of an experimental investigation on the formation mechanism and physical characterization of simulated nuclear aerosols that could likely be released during an HTGR core heat-up accident. Experiments were carried out in a high-temperature flow system consisting essentially of an inductively heated release source, a vapor deposition tube, and a filter assembly for collecting particulate matter. Simulated fission products Sr and Ba as oxides are separately impregnated in H451 graphite wafers and released at elevated temperatures into a dry helium flow. In the presence of graphite, the oxides are quantitatively reduced to metals, which subsequently vaporize at temperatures much lower than required for the oxides alone to vaporize in the absence of graphite. A substantial fraction of the released material is associated with particulate matter, which is collected on filters located downstream at ambient temperature. The release and transport of simulated fission product Ag as metal are also investigated.

56956 (CNEN-RT/DISP—(80)1) **Security note (with special reference to the area of nuclear plants).** Galvagni, R. (Comitato Nazionale per l'Energia Nucleare, Sede (Italy). Direzione Centrale Sicurezza Nucleare e Protezione Sanitaria). Jul 1980. 114p. (In Italian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82903063.

Arguments are discussed such as: what is safety, how safe is safe enough; quality assurance - the safety control; quality assurance - the design organization; the nuclear safety philosophy; safety methodologies; semiprobabilistic methodology - the failure rates; semiprobabilistic methodology - comparison of provisional data; and the definition of the safety objectives.

56957 (DPSTM—500-Vol.7) **JOSHUA system. Volume VII. Transient reactor physics.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1971. Contract AC09-76SR00001. 288p. NTIS (US Sales Only). Order Number DE82018093.

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This volume describes the JOSHUA modules, and the methods employed therein, which can be used for transient neutronic analysis of nuclear reactors. Kinetic few-group neutron diffusion theory and methods of solution are reviewed in this section and an overview of the TRANSIENT PHYSICS SUBSYSTEM is presented.

56958 (EGG-M—07681) **Implementing quantitative analysis and its complement.** Rasmuson, D.M.; Nelson, W.R.; Shepherd, J.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1981. Contract AC07-76ID01570. 10p. (CONF-810905—30). NTIS, PC A02/MF A01. Order Number DE82007341.

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

This paper presents an application of risk analysis for the evaluation of nuclear reactor facility operation. Common cause failure analysis (CCFA) techniques to identify potential problem areas are discussed. Integration of CCFA and response trees, a particular form of the path sets of a success tree, to gain significant insight into the operation of the facility is also demonstrated. An example illustrating the development of the risk analysis and evaluation of the CCFA is presented to explain the technique.

56959 (EGG-M—08181) **Characterization of radioactive ion exchange media waste generated at Three Mile Island.** Runion, T.C.; Holzworth, R.E.; Ogle, R.E.; Burton, H.M.; Bixby, W.W. (EG and G Idaho, Inc., Idaho Falls (USA); Karlsruhe Univ. (TH) (Germany, F.R.)). Oct 1981. Contract AC07-76ID01570. 10p. (CONF-811056—2). D. Order Number DE82007337.

From Seminar on the management of radioactive waste from nuclear power plants; Karlsruhe, F.R. Germany (5 Oct 1981).

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The March 1979 accident at General Public Utilities Nuclear Corporation (GPUNC) Three Mile Island Nuclear Power Station Unit 2 (TMI-2), resulted in the transfer of more than 1100 m^3 of contaminated water to the auxiliary and fuel handling building. The principal sources of the water were the makeup and letdown purification system and the containment building sump. The contaminated water was processed through an ion exchange system designated as EPICOR II. The EPICOR-II System is a three-stage process. The contaminated water passes through a first stage of ion exchange media, designated as prefilters, and then through the second and third stages, designated as demineralizers. The majority of the activity was deposited in the first-stage prefilters, which have a maximum administrative loading limit of 1300 curies. The predominant radionuclides present in the prefilters are cesium and strontium.

56960 (IKH—97/78) **Loads on reactor pressure vessel internals induced by low-pressure waves.** Benkert, J.; Mika, C.; Stegemann, D.; Valero, M. (Hannover Univ. (Germany, F.R.). Inst. fuer Kerntechnik). Feb 1978. 42p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

Departing from the conservation theorems for mass and impulse the computer code DRUWE has been developed which allows to calculate loads on the core shell with simplifying assumptions for the first period just after the rupture has opened. It can be supposed that the whole rupture cross section is set free within 15 msec. The calculation progresses in a way that for a core shell the local, timely pressure- and load development, respectively, the total dynamic load as well as the moments acting on the fixing of the core shell, can be calculated. The required input data are merely geometric data on the concept of the pressure vessel and its components as well as the effective subcooling of the fluid. By means of some parameters the programm development can be controlled in a way that the results are available in form of listings or diagrams, respectively, as well as in form of card decks for following investigations, e.g. solidity calculations.

56961 (INIS-mf—7092, pp vp) **Concept of safety of nuclear power plants and nuclear heat and power plants with regard to their environmental impacts.** Suchomel, J. (Vyskumny Ustav Energeticky, Jaslovske Bohunice (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The safety system is described of nuclear power plants of the WWER type. The system is rated for maximum design-basis LOCA accident. The consequences of such accidents are removed by the bubble-tray type pressure suppression system in the WWER 440 plants and by the containment shell in the WWER 1000 plants. (J.P.).

56962 (INIS-mf—7092, pp vp) **Principle of optimizing radiation protection in nuclear power.** Sevc, J.; Kunz, E. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The biological effects of radiation on man may be divided into non-stochastic, i.e., those which may occur in the operation of a nuclear installation only as a consequence of the long-term and considerable exceedance of maximal permissible doses or owing to a radiation accident, and stochastic effects, i.e., such in which even a small dose of radiation may cause probable damage to the organism. The principle of optimization is described which determines the level of permissible exposure such as to be adequate to the social benefit of the nuclear installation in relation to the development of nuclear power. Several examples are given of the application of this method in practice. The advantage of the optimization technique consists in the possibility of evaluating the cost-benefit ratio of nuclear installations as related to the radiation protection of the personnel of these installations and the environment with the aim of maximally reducing collective exposure.

56963 (INIS-mf—7092, pp vp) **Deactivation and dismantling of nuclear power plants after their decommissioning.** Tomik, L. (Atomova Elektraren Bohunice, Jaslovske Bohunice (Czechoslovakia)); Hladky, E.; Zizka, B. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

A brief survey is given of methods used in the decontamination of nuclear power installations and their equipment. The choice of method and deactivation means are dependent on a number of factors such as the character and form of the contaminant, the chemical composition of the deactivation material, the shape of the surface, its mechanical and/or chemical treatment, the required reduction in radiation level and the type of reactor concerned. The problem is discussed of the deactivation of the equipment of the nuclear installation prior to shut-down and final decommissioning. The basic variants of decommissioning are given, i.e., mothballing (putting the facility in a state of protective storage), in-place entombment, immediate removal of radioactive components and dismantling or the combination of the three methods.

56964 **(LA-UR—82-1946) SIMMER as a safety analysis tool.** Smith, L.L.; Bell, C.R.; Bohl, W.R.; Bott, T.F.; Dearing, J.F.; Luck, L.B. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 10p. (CONF-820704—21). NTIS, PC A02/MF A01. Order Number DE82019568.

From International topical meeting on LMFBR safety; Lyon, France (18 Jul 1982).

SIMMER has been used for numerous applications in fast reactor safety, encompassing both accident and experiment analysis. Recent analyses of transition-phase behavior in potential core disruptive accidents have integrated SIMMER testing with the accident analysis. Results of both the accident analysis and the verification effort are presented as a comprehensive safety analysis program.

56965 **(LA-UR—82-1947) SIMMER analysis of SRI postdisassembly expansion experiments.** Bott, T.F.; Bell, C.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 12p. (CONF-820704—20). NTIS, PC A02/MF A01. Order Number DE82019567.

From International topical meeting on LMFBR safety; Lyon, France (18 Jul 1982).

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Calculations of simulated postdisassembly expansions with SIMMER-II are compared to experimental data. The main features of the fluid motion are reproduced accurately. Good agreement is achieved for the important parameters of kinetic energy and impulse imparted to the vessel head. The most important calculated results are shown to be relatively insensitive to numerical modeling variations and uncertainties in many physical parameters. The geometric configuration of the upper internal structures is shown to affect significantly the vessel head impact energy and impulse.

56966 **(LA-UR—82-1948) Calculational advance in the modeling of fuel-coolant interactions.** Bohl, W.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 13p. (CONF-820704—19). NTIS, PC A02/MF A01. Order Number DE82019556.

From International topical meeting on LMFBR safety; Lyon, France (18 Jul 1982).

A new technique is applied to numerically simulate a fuel-coolant interaction. The technique is based on the ability to calculate separate space- and time-dependent velocities for each of the participating components. In the limiting case of a vapor explosion, this framework allows calculation of the pre-mixing phase of film boiling and interpenetration of the working fluid by hot liquid, which is required for extrapolating from experiments to a reactor hypothetical accident. Qualitative results are compared favorably to published experimental data where an iron-alumina mixture was poured into water. Differing results are predicted with LMFBR materials.

56967 **(NUREG—0090-V4-N1) Report to Congress on abnormal occurrences. Quarterly report Jan-Mar 81.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jul 1981. 33p. NTIS, PC A03/MF A01.

Section 208 of the Energy Reorganization Act of 1974 identified an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determined to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period January 1 to March 31, 1981. There was one abnormal occurrence at the nuclear power plants licensed to operate; the event involved an inadvertent disconnection of station batteries. There were no abnormal occurrences at the fuel cycle facilities (other than nuclear power plants). There was one abnormal occurrence at other licensee facilities; the event involved occupational overexposures. There were no abnormal occurrences reported by the Agreement States. This report also contains information updating some previously reported abnormal occurrences.

56968 **(NUREG—0090-V4-N3) Report to Congress on abnormal occurrences, July-September 1981. Quarterly report.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jan 1982. 41p. NTIS, PC A03/MF A01.

During the report period, there were two abnormal occurrences at the nuclear power plants licensed to operate. One involved a misalignment of a high head safety injection isolation valve. The other involved a failure of the high pressure safety injection system. There were two abnormal occurrences at other licensee facilities. Both involved calculated radiation exposures in excess of 10 CFR 20 limits. There were two abnormal occurrences reported by the Agreement States. One involved excessive radiation doses to hospital patients. The second involved overexposures of a radiographer and two barge crew members. The report also contains information updating some previously reported abnormal occurrences.

56969 **(NUREG—0485-V3-N13) Systematic evaluation program status summary report: November 1-30, 1981.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Dec 1981. 108p. NTIS, PC A06/MF A01.

The Systematic Evaluation Program is intended to examine many safety related aspects of eleven of the older light water reactors. This document provides the existing status of the review process including individual topic and overall completion status.

56970 **(NUREG—0606-V4-N1) Unresolved safety issues summary: aqua book. Report for 16 Nov 81-19 Feb 82.** (Nuclear Regulatory Commission, Washington, DC (USA)). Mar 1982. 51p. NTIS, PC A04/MF A01.

The report provides an overview of the status of the progress and plans for resolution of the generic tasks addressing 'Unresolved Safety Issues' as reported to Congress.

56971 **(NUREG—0698-REV-1) NRC plan for cleanup operations at Three Mile Island Unit 2.** Lo, R.; Snyder, B. (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1982. 35p. NTIS, PC A03/MF A01.

This NRC Plan, which defines NRC's functional role in cleanup operations at Three Mile Island Unit 2 and outlines NRC's regulatory responsibilities in fulfilling this role, is the first revision to the initial plan issued in July 1980 (NUREG-0698). Since 1980, a number of policy developments have occurred which will have an impact on the course of cleanup operations. This revision reflects these developments in the area of NRC's review and approval process with regard to cleanup operations as well as NRC's interface with the Department of Energy's involvement in the cleanup and waste disposal. This revision is also intended to update the cleanup schedule by presenting the cleanup progress that has taken place and NRC's role in ongoing and future cleanup activities.

56972 **(NUREG—0713-V2) Occupational radiation exposure at commercial nuclear power reactors, 1980. Annual report.** Brooks, B.G. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Dec 1981. 110p. NTIS, PC A06/MF A01.

This report summarizes the occupational radiation exposure information that has been reported to the U.S.N.R.C. by commercial nuclear power reactors during the years 1969 through 1980. The bulk of the data presented in the report was obtained from annual radiation exposure reports submitted in accordance with the requirements of 10 CFR 20.407 and Regulatory Guide 1.16. Data on workers terminating their employment at nuclear power facilities was obtained from reports submitted pursuant to 10 CFR 20.408. The annual reports submitted by the 69 nuclear power plants that had completed at least one full year of operation as of December 31, 1980, indicated that the number of personnel monitored during 1980 was 133,898 persons and the annual collective dose incurred by these individuals was 53,796 man-rems. The average annual dose for each worker that received a measurable dose was 0.7 rems, and the average collective dose per reactor was 791 man-rems. The termination reports revealed that some 57,800 individuals completed their employment with one or more reactor facilities during 1980. Approximately 3,900 of these workers could be considered transients and they received an average dose of about 1 rem.

56973 **(NUREG—0864) Review and evaluation of the Nuclear Regulatory Commission safety research program for Fiscal Year 1983. Report to the Congress.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Feb 1982. 75p. NTIS, PC A04/MF A01.

Public Law 95-209 includes a requirement that the Advisory Committee on Reactor Safeguards submit an annual report to Congress on the safety research program of the Nuclear Regulatory Commission. This report presents the results of the ACRS review and evaluation of the NRC safety research program for Fiscal Year 1983. The report contains a number of comments and recommendations.

56974 **(NUREG—0880) Safety goals for nuclear power plants: a discussion paper.** (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1982. 73p. NTIS, PC A04/MF A01.

This report includes a proposed policy statement on safety goals for nuclear power plants published by the Commission for public comment and a supporting discussion paper. Proposed qualitative goals and associated numerical guidelines for nuclear power-plant accident risks are presented. The significance of the goals and guidelines, their bases and rationale, and their proposed mode of implementation are discussed.

56975 **(NUREG—0886) Steam generator tube experience.** Cheng, C.Y. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1982. 66p. NTIS, PC A04/MF A01.

This report provides information pertaining to the status of PWR steam generator tube experience and the resolution of unresolved safety issues A-3, A-4, and A-5 regarding steam generator tube integrity. It provides an overview of the types of problems which have occurred in PWR steam generators with particular emphasis on recent operating experience. The report also discusses short- and long-term corrective actions being pursued by the industry to resolve these problems, steam generator inspection and repair requirements which have been established to ensure the continued safe operation of PWR steam generators, and occupational radiation exposures associated with the above-listed activities.

56976 **(NUREG/CR—2263) Assessment of center-line lack of penetration in stainless steel pipe (ASTM A-312, ASME SA-312). Final report Feb 80-Sep 81.** Kelly, H.; Liss, J.; Leonard, L. (Franklin Research Center, Philadelphia, PA (USA)). Dec 1981. 56p. NTIS, PC A04/MF A01.

This report summarizes results of a testing and evaluation program aimed at establishing the detectability of and severity of Centerline Lack of Penetration (C.L.P.) in stainless steel pipe manufactured in accordance with ASTM A-312 and ASME SA-312 procedures. Examination was performed on pipe sections supplied by US NRC. Weld conditions were checked by etching ends of pipe samples and by metallographic examination. Ultrasonic inspection techniques were utilized to explore the possibility of N.D.E. for CLP condition. Metallographic examination has shown some diffusion bonding across the interface (at lack of penetration), which would increase joint strength and reduce detectability via ultrasound. Other laboratories (APTECH Engineering Services) have studied the CLP problem with regard to material performance (safety margin and remaining fatigue life) and have found large margins of safety in existing pipe. As a result of this study, the removal of installed A-312 and SA-312 stainless steel piping is considered to be an overly cautious measure.

56977 **(NUREG/CR—2331-Vol.1-No.4) Safety research programs sponsored by Office of Nuclear Regulatory Research. Quarterly progress report, October 1-December 31, 1981.** Cerbone, R.J.; Diamond, D.J.; Ginsberg, T.; Guppy, J.G.; Reich, M.; Saha, P.; Sastre, C.; Weeks, J.R.; Wulff, W.; van Rooyen, D. (Brookhaven National Lab., Upton, NY (USA)). Feb 1982. Contract AC02-76CH00016. 156p. (BNL-NUREG—51454-Vol.1-No.4). NTIS, PC A08/MF A01 - GPO.

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This progress report will continue to describe current activities and technical progress in the programs at Brookhaven National Laboratory sponsored by the US Nuclear Regulatory Commission, Office of Nuclear Regulatory Research. The projects reported each quarter are the following: HTGR Safety Evaluation, SSC Code Development, Thermal Hydraulic LWR and LMFBR Safety Experiments, RAMONA-3B Code Modification and Evaluation, LWR Plant Analyzer Development Program, LWR Code Assessment and Application, Stress Corrosion Cracking of PWR Steam Generator Tubing, Standards for Materials Integrity in LWRs, Probability Based Load Combinations for Structural Design, Mechanical Piping Benchwork Problems, and Soil Structure Interaction.

56978 **(NUREG/CR—2367) Updated best-estimate LOCA radiation signature. Final report.** Thayer, D.D.; Houston, D.H.; Lurie, N.A. (IRT Corp., San Diego, CA (USA)). Aug 1981. 53p. (IRT—6406-002). NTIS, PC A04/MF A01.

Proper radiation qualification of nuclear power plant equipment depends upon estimating the radiation environment in which equipment will be expected to perform. Over the past several years, the Qualification Testing Evaluation (QTE) Program being conducted by Sandia Laboratories for the U.S. Nuclear Regulatory Commission has been addressing the problem of radiation source term definition. As part of the QTE Program, IRT Corporation has conducted studies (Refs. 1-4) focusing on expected source terms resulting from the hypothesized loss-of-coolant accident (LOCA). The objective of the study was to review research conducted since the last study and make modifications and improvements in the 'best-estimate' LOCA radiation signature. This report contains a review of the fission product source terms literature since 1978, changes made in the 'best-estimate' source term, comparisons with the previous 'best-estimate' source term in Ref. 4, and suggestions for future work.

56979 **(NUREG/CR—2373) GAMMA: a code for the analysis of component failure rates with a compound Poisson-gamma model. Final technical report.** Shultis, J.K.; Johnson, D.E.; Milliken, G.A.; Eckhoff, N.D. (Kansas State Univ., Manhattan (USA). Dept. of Nuclear Engineering). Dec 1981. 83p. NTIS, PC A05/MF A01.

The theory is summarized for the homogeneous Poisson and the compound gamma-Poisson probability models which can be used to analyze failure rate attribute data consisting of the number of failures in specified test times for normally operating components or systems. A computer code based on this theory is described, and instructions for its use together with a sample problem and a complete code listing are presented. For the compound model, used in a

Bayesian analysis of failure rate data, values of the parameters for the prior gamma distribution, chosen a priori, are estimated from observed failure data by three methods: (1) matching the data moments to those of the prior distribution, (2) matching the data moments to those of the marginal distribution, and (3) the marginal maximum likelihood method. Many program options are available including variance estimates for the prior parameter estimators, posteriori analyses for each component, various statistical comparisons between the homogeneous and compound models, and generalized chi-square and Kolmogorov-Smirnov goodness-of-fit tests for determining how well the failure models describe the observed data.

56980 (NUREG/CR—2374) Use on non-conjugate prior distributions in compound failure models. Final technical report. Shultis, J.K.; Johnson, D.E.; Milliken, G.A.; Eckhoff, N.D. (Kansas State Univ., Manhattan (USA). Dept. of Nuclear Engineering). Dec 1981. 141p. NTIS, PC A07/MF A01.

Several theoretical and computational techniques are presented for compound failure models in which the failure rate or failure probability for a class of components is considered to be a random variable. Both the failure-on-demand and failure-rate situation are considered. Ten different prior families are presented for describing the variation or uncertainty of the failure parameter. Methods considered for estimating values for the prior parameters from a given set of failure data are (1) matching data moments to those of the prior distribution, (2) matching data moments to those of the compound marginal distribution, and (3) the marginal maximum likelihood method. Numerical methods for computing the parameter estimators for all ten prior families are presented, as well as methods for obtaining estimates of the variances and covariance of the parameter estimators, it is shown that various confidence, probability, and tolerance intervals can be evaluated. Finally, to test the resulting failure models against the given failure data, generalized chi-squage and Kolmogorov-Smirnov goodness-of-fit tests are proposed together with a test to eliminate outliers from the failure data. Computer codes based on the results presented here have been prepared and are presented in a companion report (NUREG/CR-2375).

56981 (NUREG/CR—2450) Shear transfer in large scale reinforced concrete containment elements. Report No. 2. Technical report. Oesterle, R.G.; Russell, H.G. (Portland Cement Association, Skokie, IL (USA). Construction Technology Labs.). Dec 1981. 180p. NTIS, PC A09/MF A01.

The report presents results of an experimental program to investigate shear transfer in a cracked containment vessel without diagonal reinforcement. The test setup was designed and constructed to simulate boundary conditions of a wall element of a pressurized containment subjected to tangential shear stresses. The experimental program included monotonic and reversing load tests on large-scale specimens subjected to biaxial tension and shear. The specimens were 5-ft square and 2-ft thick with No. 14 and No. 18 reinforcement. Results of three monotonic and two reversing load tests are given. Test variables were level of biaxial tension and monotonic or reversing shear load. Observed behavior, strength, and deformations are discussed. Tentative design recommendations are presented.

56982 (NUREG/CR—2451) Behavioral model for reinforced concrete panels under cyclic shear. Technical report. Tseng, T.; Calvo, J.; Buyukozturk, O.; Conner, J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Civil Engineering). Dec 1981. 110p. NTIS, PC A06/MF A01.

In the first part of this report recent models of shear transfer across continuous cracks penetrating through the thickness of reinforced concrete specimens under monotonic loading are briefly reviewed. The models proposed by Leombruni and Jimenez are applied to the tests conducted by the Portland Cement Association (PCA). In the second part of this report a numerical model is developed to predict the behavior of orthogonally reinforced concrete wall panels subjected to the combined action of tension and cyclic shear. The model is based on the experimental results obtained by PCA in the testing of the RB5 and RB6 specimens. The applicability of the model is verified by comparing the predicted results with those obtained from the recent tests by Cornell University. The proposed model shows excellent agreement with the experimental results. The applicability of this cyclic shear model to the analysis and design of nuclear containment structures is discussed.

56983 (NUREG/CR—2507) Background and derivation of ANS-5.4 standard fission product release model. Technical report. (Southern Science Applications, Inc., Dunedin, FL (USA)). Jan 1982. 160p. NTIS, PC A08/MF A01.

ANS Working Group 5.4 was established in 1974 to examine fission product releases from UO2 fuel. The scope of ANS-5.4 was narrowly defined to include the following: (1) Review available experimental data on release of volatile fission products from UO2 and mixed-oxide fuel; (2) Survey existing analytical models currently being applied to lightwater reactors; and (3) Develop a standard analytical model for volatile fission product release to the fuel rod void space. Place emphasis on obtaining a model for radioactive fission product releases to be used in assessing radiological consequences of postulated accidents.

56984 (NUREG/CR—2520) Hydrodynamic analysis of the electron-beam-vaporization experiments for UO_2. Ganapol, B.D.; Clark, B.A.; Smith, M.S.; Sowers, G.W. (Arizona Univ., Tucson (USA). Dept. of Nuclear and Energy Engineering). Jul 1982. 63p. GPO $5.00.

The electron-beam experiments designed to generate high temperature vapor pressure data for UO_2 vapor is analyzed by three hydrodynamic codes SIMMER, FARA and VIOLET. The physical and numerical modeling in each code is different, thus providing a modeling error associated with the analysis. Agreement with the experiment is rather poor indicating that the rate dependent specific heat capacity model proposed by Benson may not be a physical reality.

56985 (NUREG/CR—2837) PNL technical review of pressurized thermal-shock issues. Pedersen, L.T.; Apley, W.J.; Bian, S.H.; Defferding, L.J.; Morgenstern, M.H.; Pelto, P.J.; Simonen, E.P.; Simonen, F.A.; Stevens, D.L.; Taylor, T.T. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 144p. (PNL—4327). NTIS, PC A07/MF A01 - GPO $6.50.

Pacific Northwest Laboratory (PNL) was asked to develop and recommend a regulatory position that the Nuclear Regulatory Commission (NRC) should adopt regarding the ability of reactor pressure vessels to withstand the effects of pressurized thermal shock (PTS). Licensees of eight pressurized water reactors provided NRC with estimates of remaining effective full power years before corrective actions would be required to prevent an unsafe operating condition. PNL reviewed these responses and the results of supporting research and concluded that none of the eight reactors would undergo vessel failure from a PTS event before several more years of operation. Operator actions, however, were often required to terminate a PTS event before it deteriorated to the point where failure could occur. Therefore, the near-term (less than one year) recommendation is to upgrade, on a site-specific basis, operational procedures, training, and control room instrumentation. Also, uniform criteria should be developed by NRC for use during future licensee analyses. Finally, it was recommended that NRC upgrade nondestructive inspection techniques used during vessel examinations and become more involved in the evaluation of annealing requirements.

56986 (NUREG/CR—2874-Vol.1) High-temperature gas-cooled reactor safety studies for the Division of Accident Evaluation. Quarterly progress report, January 1-March 31, 1982. Ball, S.J.; Clapp, N.E. Jr.; Cleveland, J.C.; Conklin, J.C.; Harrington, R.M.; Kelmers, A.D.; Kornegay, F.C. (Oak Ridge National Lab., TN (USA)). Sep 1982. Contract W-7405-ENG-26. 15p. (ORNL/TM—8443-Vol.1). NTIS, PC A02/MF A01 - GPO.

Continuing code development work included improvements to the BLAST steam generator dynamics simulation for the Fort St. Vrain reactor and implementation of a simplified version of the core model CORTAP. Work continued on severe accident sequence analyses, including further work on the ORECA code three-dimensional core simulation and a new effort to review the fission-product release and transport methodology. Work was also started on a siting study for a 2240-MW(t) high temperature gas-cooled reactor plant design.

56987 **(PB—82-180217) Development of a three-dimensional two-fluid code with transient neutronic feedback for LWR applications. Final report.** Griggs, D.P.; Henry, A.F.; Kazimi, M.S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1981. 67p. (MIT-EL—81-013). NTIS, PC A04/MF A01.

The development of a three-dimensional coupled neutronics/thermal-hydraulics code for LWR safety analysis has been initiated. The transient neutronics code QUANDRY has been joined to the two-fluid thermal-hydraulics code THERMIT with the appropriate feedback mechanisms modeled. A literature review of the existing coupled neutronics/thermal-hydraulics codes is presented. It indicates that all of the known codes have limitations in their neutronic and/or thermal-hydraulic models which limit their generality of application and accuracy. It was also found that a tandem coupling scheme was most often employed and generally performed well. A detailed steady-state and transient coupling scheme based on the tandem technique was devised, taking into account the important operational characteristics of QUANDRY and THERMIT. The two codes were combined and the necessary programming modifications were performed to allow steady-state calculations with feedback. A simple steady-state sample problem was produced for the purpose of testing and debugging the coupled code.

56988 **(PB—82-180225) THERMIT-2: a two-fluid model for light water reactor subchannel transient analysis. Final report.** Kelly, J.E.; Kao, S.P.; Kazimi, M.S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1981. 318p. (MIT-EL—81-014). NTIS, PC A14/MF A01.

The broad effort of developing and assessing the two fluid model computer code THERMIT for light water reactor (LWR) subchannel analysis is described. The developmental effort required a reformulation of the coolant-to-fuel rod coupling so that THERMIT is now capable of traditional coolant-centered subchannel analysis. A model that accounts for mass, momentum and energy transport between mesh cells due to turbulent mixing for two-phase conditions has also been introduced. This model is the first such attempt in a two-fluid context. The liquid-vapor interfacial exchange terms in the two-fluid model have been modified for improved accuracy. A systematic evaluation of the exchange models has been performed. The mass and momentum exchange rates between the vapor and the liquid for pre-CHF conditions were evaluated by comparison to void fraction data in over 30 one-dimensional steady-state experiments reported in the open literature. The liquid-vapor energy exchange rate for post-CHF conditions was assessed using 15 steady-state, one-dimensional wall temperature measurements. The mixing model was tested against G.E. and Ispra BWR and PWR rod-bundle measurements. Comparisons with these measurements have shown the appropriateness of this model.

56989 **(PB—82-180233) COBRA IIIc/MIT-2: a digital computer program for steady state and transient thermal-hydraulic analysis of rod bundle nuclear fuel elements. Final report.** Jackson, J.W.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1981. 428p. (MIT-EL—81-018). NTIS, PC A19/MF A01.

The COBRA IIIc/MIT-2 computer program computes the flow and enthalpy in rod-bundle nuclear fuel element subchannels during both steady state and transient conditions. It uses a mathematical model which considers both turbulent and diversion crossflow mixing between adjacent subchannels. Each subchannel is assumed to contain one-dimensional, two-phase, separated, slip-flow. The two-phase flow structure is assumed to be fine enough to define the void fraction as a function of enthalpy, flow-rate, heat-flux, pressure, position and time. At the present time, steady-state two-phase flow correlations are assumed to apply to transients. The mathematical model neglects sonic velocity propagation; therefore, it is limited to transients where the transient times are greater than the time for a sonic wave to pass through the channel. The equations of the mathematical model are solved by using a semi-explicit finite difference scheme. This scheme also gives a boundary-value flow solution for both steady state and transients where the boundary conditions are the inlet enthalpy, inlet mass velocity, and exit pressure.

56990 **(UCLA-ENG—7834) Use of expert opinion in the evaluation of probabilities of rare events.** Apostolakis, G.; Mosleh, A. (California Univ., Los Angeles (USA). Dept. of Chemical, Nuclear, and Thermal Engineering). Jun 1978. Contract AT03-76SF70252. 88p. NTIS, PC A05/MF A01. Order Number DE82008521.

Portions of document are illegible.

The evaluation of probabilites of rare events in the context of the subjectivistic theory of probability is the subject of this work. Several useful subsidiary methods for the achievemnet of coherent probabilities are discussed with particular emphasis on experts' opinions. As an application, a distribution for the frequency of reactor core melts is assessed using the available experience with power reactors. This distribution is subsequently modified, via Bayes' theorem, to include the estimate derived by WASH-1400, which is treated as an expert's opinion. A probabilistic model for the credibility of this opinion is presented, which includes the critics' point of view. The resulting (posterior) distribution is the assessed distribution of the frequency of reactor core melts based on a body of knowledge which includes the available experience and the WASH-1400 estimate.

56991 **Slipforming of reinforced concrete shield building.** Hsieh, M.C.; King, J.R. (Ebasco Serv Inc, New York, NY). *Journal of the Construction Division, Proceedings of the ASCE (American Society of Civil Engineers);* **108**: No. CO1, 63-73(Mar 1982).

The unique design and construction features of slipforming the heavily reinforced concrete cylindrical shield walls at the Satsop nuclear plant in Washington, D.C. site are presented. The shield walls were designed in compliance with seismic requirements which resulted in the need for reinforcing steel averaging 326 kg/m/sup 3/. A 7.6 m high, three-deck moving platform was designed to permit easy installation of the reinforcing steel, embedments, and blockouts, and to facilitate concrete placement and finishing. Two circular box trusses, one on each side of the shield wall, were used in combination with a spider truss to meet both the tolerance and strength requirements for the slipform assembly.

56992 **Hydrogen permeation resistant barrier.** Brehm, W.F.; Mcguire, J.C. (to Department of Energy). US Patent 4,314,880. 9 Feb 1982. Filed date 8 Feb 1980. vp.

PAT-APPL-119740.

A hydrogen permeation resistant barrier is formed by diffusing aluminum into an iron or nickel alloy and forming an intermetallic aluminide layer.

56993 **Effects of flow dispersers upstream of two-phase flow monitoring instruments.** Sheppard, J.D.; Thomas, D.G.; Tong, L.S. (Oak Ridge Natl Lab, Tenn). *International Journal of Multiphase Flow;* **8**: No. 1, 59-70(Feb 1982).

The effects of flow dispersing screens on the accuracy of two-phase flow monitoring instruments was studied with an air-water two-phase flow loop in which air and water flow rates were monitored separately. Flow dispersers were installed at the inlet of an instrumented spool piece containing a drag disk and a turbine meter. When the turbine was upstream of the drag disk, two-phase mass flow rates indicated by the instruments were approximately one-third actual mass flows both in the presence and absence of flow dispersers. 12 refs.

56994 **Critical heat flux predictions during blowdown transients.** Leung, J.C.M.; Gallivan, K.A.; Henry, R.E.; Bankoff, S.G. (Argonne Natl Lab, Ill, USA). *International Journal of Multiphase Flow;* **7**: No. 6, 677-701(Dec 1981).

The onset of critical flux (CHF) during abnormal conditions and hypothetical accidents of an operating nuclear reactor is of utmost importance in the safety analysis and licensing calculation. The present study focused attention primarily on the pressurized water reactor (PWR) system since the associated loss-of-coolant accident (LOCA) would result in the most rapid and severe thermal-hydraulic transient. This study provides guidelines for prediction of

CHF during blowdown under different flow and pressure conditions. 34 refs.

56995 **Effects of grid turbulence on nonequilibrium choked nozzle flow.** Fincke, J.R.; Collins, D.R.; Wilson, M.L. (Edgerton, Germeshausen & Grier Inc, Idaho Falls, ID). *American Society of Mechanical Engineers, [Paper];* No. 81-WA/HT-58, vp(Nov 1981).

Experiments were conducted to investigate the role played by grid-produced turbulence on the nonequilibrium choking process in short nozzles with subcooled upstream conditions. Grids were placed upstream of the nozzle to alter the intensity and scale of turbulence. These changes were reflected in the degree of thermodynamic nonequilibrium in the nozzle and in the critical mass flux. It was found that the data were ordered logically by the turbulent integral-length scale. Subsequently, a nonequilibrium vapor generation model based on a description of the turbulent transport of thermal energy was developed. The vapor generation model was combined with conservation equations to define the critical flow condition. This model was then examined with respect to data available in the open literature. 9 refs.

56996 **Transient natural convection adjacent to a vertical flat surface: the thermal capacity effect.** Sammakia, B.; Gebhart, B. (State Univ of New York at Buffalo, Amherst, USA). *Numerical Heat Transfer;* **4**: No. 3, 331-344(Jul-Sep 1981).

A finite-difference numerical scheme is employed to obtain transient response solutions to the time-dependent partial differential equations describing the flow adjacent to a uniformly heated vertical flat plate. The plate is a finite thickness and has an appreciable thermal capacity. It is assumed to be immersed in an extensive quiescent body of fluid that has a Prandtl number of 7.6 as for water around room temperature. Extensive calculations of the effect of the thermal capacity of the plate on the nature of the transient flow behavior have been carried out. The resulting flow regimes are analyzed in detail. This work is pertinent to nuclear reactor safety. 6 refs.

56997 **Safety and operating experience at EBR-II: lessons for the future.** Sackett, J.I.; Golden, G.H. (Argonne Natl Lab, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **2**: 1603-1607(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This paper discusses safety aspects of the operating experience at EBR-II and the lessons learned thus far from that experience. Increasingly, this learning process is focusing on the importance of using inherent safety-related characteristics of LMFBR power plants to assure public safety and also to enhance protection of the plant itself. 19 refs.

56998 **Effect of accidental steam entry on gas-cooled fast reactor integral neutronics parameters.** Bhattacharyya, S.K.; Morman, J.A.; Bucher, R.G.; Smith, D.M.; Robinson, W.R.; Bennett, E.F. (Argonne Natl Lab, Ill). *Nuclear Technology;* **50**: No. 3, 197-218(Oct 1980).

A possible accident scenario in a gas-cooled fast reactor (GCFR) is the leakage of secondary steam into the core. A full-scale experimental study of the physics effects of such an accidental condition has been performed on the zero power reactor (ZPR)-9 critical facility at Argonne National Laboratory. The results of integral neutronics measurements performed on the simulated steam-flooded GCFR core are reported, and comparisons with corresponding results for the reference GCFR core presented. Results of calculations of these parameters with ENDF/B-IV nuclear data and standard design methods are also presented. 26 refs.

56999 **TREAT Test E8 simulating liquid-metal fast breeder reactor /3/s overpower accident with irradiated Fast Test Reactor type fuel.** Simms, R.; Lo, R.K.; Murphy, W.F.; Rothman, A.B.; Stanford, G.S. (Argonne Natl Lab, Ill). *Nuclear Technology;* **50**: No. 3, 225-241(Oct 1980).

In a transient overpower (TOP) accident, the fuel element failure threshold is a function of the rate of reactivity increase and the fuel microstructure. In Transient Reactor Test Facility (TREAT) Test E8, seven mixed-oxide PNL-10 elements from the Experimental Breeder Reactor II (EBR-II) subassembly X093 were used in a simulation of an unprotected /3/s transient overpower (TOP) accident in a liquid-metal fast breeder reactor (LMFBR). This paper presents the results of Test E8. Experimental hardware is also described. 9 refs.

57000 **Evaluation of fuel motion in recent TREAT experiments with liquid-metal fast breeder reactor fuel.** Simms, R. (Argonne Natl Lab, Ill). *Nuclear Technology;* **50**: No. 3, 257-266(Oct 1980).

In the past few years since the introduction of the 1.2-m-high Hodoscope Collimator, a number of TREAT experiments have been conducted with liquid-metal fast breeder reactor (LMFBR) fuel having 864- to 914-mm-long active fuel columns. The purpose of this study was to examine the fuel-motion results obtained from the hodoscope for some of these tests by relating the importance of the fuel motion to the associated LMFBR safety issues. The experiments discussed here represent the current limit in the state-of-the-art in LMFBR safety testing in the TREAT reactor. 8 refs.

57001 **One-dimensional penetration of molten UO/sub 2/ into substrate limestone concrete.** Farhadieh, R.; Gunther, W.H. (Argonne Natl Lab, Ill). *Nuclear Technology;* **50**: No. 3, 298-306(Oct 1980).

An experimental study of the downward penetration of molten UO/sub 2/ into substrate limestone concrete was conducted. The purpose of this study is to qualitatively understand penetration of UO/sub 2/ into concrete and the dissolution nature of concrete constituents in UO/sub 2/. 11 refs.

57002 **Unavailability of systems under periodic test and maintenance.** Apostolakis, G.; Chu, T.L. (Univ of Calif, Los Angeles). *Nuclear Technology;* **50**: No. 1, 5-15(Aug 1980).

The engineered safety systems of nuclear power plants are normally inactive. To ensure their operability, they are tested and, if needed, repaired at periodic intervals (usually once every month). The quantity of interest in such situations is the system unavailability. The purpose of this paper is to develop simple analytical expressions for the average unavailability of periodically tested redundant systems. 15 refs.

57003 **Analysis of boiling water reactor long-term cooling.** Lahey, R.T. Jr.; Kamath, P.S. (Rensselaer Polytech Inst, Troy, NY). *Nuclear Technology;* **49**: No. 1, 51-60(Jun 1980).

A closed-form analytical model for the long-term cooling of a boiling water reactor (BWR) has been derived and is presented in this paper. This model, which is based on one-dimensional, drift-flux techniques, has been compared with data from simulated full-scale 49-rod BWR fuel bundles at atmospheric pressure. 6 refs.

57004 **Acoustic measurement of penetration of liquid sodium into limestone concrete.** Sutherland, H.J.; Smaardyk, J.E.; Kent, L.A. (Sandia Lab, Albuquerque, NM). *Nuclear Technology;* **49**: No. 1, 70-79(Jun 1980).

An acoustic, pulse-echo technique has been used as part of the large-scale, sodium/concrete interaction tests being conducted at Sandia Laboratories to measure the penetration of a large pool (up to 186 kg) of liquid sodium (initial temperature as high as 600/degree/C) into a limestone concrete crucible. This paper reports the acoustic results from four test, sodium/concrete interaction test program being conducted at Sandia Laboratories. 11 refs.

57005 **Visual in-pile fuel disruption experiments.** Cano, G.L.; Ostensen, R.W.; Young, M.F. (Sandia Lab, Albuquerque, NM). *Nuclear Technology;* **49**: No. 1, 9-18(Jun 1980).

In a loss-of-flow (LOF) accident in a liquid-metal fast breeder reactor, the mode of disruption of fuel may determine the probability of a subsequent energetic excursion. To investigate these phenomena, in pile disruption of fission-heated irradiated fuel pellets was recorded by high-speed cinematography. Instead of fuel frothing or dust cloud breakup (as used in the SAS code) massive and very rapid fuel swelling, not predicted by analytical models, occurred. These tests support massive fuel swelling as the initial mode of fuel disruption in an LOF accident. 10 refs.

57006 **Implications of in-channel plugging during fast reactor overpower excursions.** Varela, D.W.; Kastenberg, W.E.; Dhir, V.K. (Sandia Lab, Albuquerque, NM). *Nuclear Technology;* **49**: No. 1, 102-114(Jun 1980).

The implications of in-channel fuel plugging subsequent to a transient overpower accident in a liquid-metal fast breeder reactor have been investigated and are discussed in this paper. The potential for cooling plugged coolant channels was examined by assuming the formation of a porous blockage in several adjacent subassemblies (from flat-to-flat) at axial locations near the upper plane of the active core. 14 refs.

57007 **Decommissioning methods and equipment.** LaGuardia, T.S. (Nucl Energy Serv Inc, Danbury, CT). pp 427-441 of Decontamination and decommissioning of nuclear facilities. New York, NY; Plenum Press (1980).

From Decontamination and decommissioning of nuclear facilities conference; Sun Valley, ID, USA (16 Sep 1979).

This paper briefly describes the primary methods and equipment that have been developed and used in decommissioning. The major areas include: decontamination; removal of contaminated piping and components; vessel and internals cutting methods; and removal of radioactive concrete. The equipment required for these major activities is available and has been satisfactorily demonstrated for these applications.

57008 **Management of the DOE inventory of excess radioactively contaminated facilities.** Kluk, A.F. (Off of Nucl Waste Manage, Washington, DC). pp 493-503 of Decontamination and decommissioning of nuclear facilities. New York, NY; Plenum Press (1980).

From Decontamination and decommissioning of nuclear facilities conference; Sun Valley, ID, USA (16 Sep 1979).

Discussed is an updated version of the "Plan for Decommissioning of DOE Radioactively Contaminated Surplus Facilities". The plan was issued in 1978, while the updated version of it is in the state of preparation. The paper shows the various locations of the surplus facilities. All the facilities are categorized by their type. The reactors include training, research, production and demonstration reactors; the tanks include both steel and concrete types but not the large million gallon tanks used for high-level waste storage. By far the largest group is waste disposal facilities which consist primarily of contaminated soil locations. The current DOE organizational structure for surplus facilities management program is shown. Ongoing decommissioning projects are enumerated. Also listed are the major facilities awaiting decommissioning.

57009 **Decommissioning the Sodium Reactor Experiment, a status report.** Kittinger, W.D.; Meyers, G.W. (Rockwell Int, Canoga Park, CA). pp 547-557 of Decontamination and decommissioning of nuclear facilities. New York, NY; Plenum Press (1980).

From Decontamination and decommissioning of nuclear facilities conference; Sun Valley, ID, USA (16 Sep 1979).

The stages of decommissioning the Sodium Reactor Experiment (SRE), the first nuclear reactor in the U.S. to produce power for supply to a commercial power grid, utilized during the period of 1957 through 1964 are described. The following operations have been already performed: fuel was removed and declad, tooling and technique development was completed, bulk sodium and sodium films and heels were removed, coolant piping was removed, in-vessel piping was removed by underwater remote explosive and plasma torch cutting, the reactor vessel assembly has been dissected by remote underwater plasma torch cutting, fuel and moderator handling machines were removed intact, and most of the contaminated support systems have been removed. Noteworthy accomplishments were made developing decommissioning tooling techniques and in demonstrating the capability to return a nuclear facility to unrestricted use.

57010 **A Boolean approach to common cause analysis.** Worrell, R.B.; Stack, D.W. (Sandia Laboratories, Albuquerque, NM). pp 363-366 of Annual reliability and maintainability symposium. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1980).

From Annual reliability and maintainability symposium; San Francisco, CA, USA (22 Jan 1980).

It is shown that a transformation of variables can be used to achieve qualitative common cause analysis. Transformation equations that relate cause events to the primary events of a fault tree are described, and the substitutions that change the minimal cut set equation for the top event of the fault tree from a function of primary events to a function of cause events are explained. Examples are presented which show that different kinds of common cause analysis are accomplished by simple modifications of the transformation equations.

25 ENERGY STORAGE

2501 Magnetic

REFER ALSO TO CITATION(S) 59063, 59064, 59065

2502 Compressed Gas

57011 **Compressed air energy storage in an aquifer.** McCafferty, T.W.; Ayers, D.L.; Bumgarner, J.M. (Publ Serv Indiana, Plainfield, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 972-977(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Public Service Indiana and four additional electric utilities studied the effects of the integration of a CAES facility with an aquifer storage formation. The study represented the second part of a five phase program initiated by the U.S. Department of Energy (DOE) and the Electric Power Research Institute (EPRI) to demonstrate a utility-integrated compressed air energy storage demonstration plant. Uncertainties related to the storage containment are an additional influence in the decision making process. Of the three geological storage formations considered for CAES, the aquifer structure was selected for this study. 2 refs.

57012 **Aquifer field test for compressed air energy storage.** Allen, R.D.; Kannberg, L.D.; Doherty, T.J. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 978-983(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

To achieve economic energy containment, the compressed air is stored below ground within solution-mined salt cavities, excavated hard rock caverns, or space made available by displacing water from porous and permeable sand-stones or carbonates. This paper addresses planned field testing of this concept by injection of air into a sandstone aquifer followed by cyclic incremental air withdrawal and injection at various temperatures. 12 refs.

57013 **Comparative economic analysis of several CAES design studies.** Reilly, R.W.; Brown, D.R. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 989-994(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Economic and design assumptions are standardized for six Compressed Air Energy Storage (CAES) designs employing different CAES technologies. The technologies investigated are conventional, hybrid, and adiabatic CAES, and CAES coupled to fluidized bed combustion and coal gasification units. A comparison is made of the economic performance of these designs (technologies) under several sets of economic assumptions in the 7.5-25% capacity factor range. Comparisons are also made against combustion turbines, oil-fired combined cycle plants, and underground pumped hydro storage (UPHS). 8 refs.

57014 **Technology status of compressed air energy storage.** Kannberg, L.D.; Loscutoff, W.V. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1:** 1005-1013(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This paper will discuss some of the key issues of CAES and how the results of recent studies affect those issues. The issues to be considered here include CAES cycles, geotechnology, surface plant equipment, economics, utility system concerns, and second-generation concepts. The role of central station energy storage for utility systems will be briefly addressed. 23 refs.

2504 Capacitor Banks

57015 **(AD-A—110409/0) Coordinated research program in pulsed power physics. Annual report No. 2, 1 Oct 80-30 Sep 81.** Kristiansen, M.; Hagler, M.O. (Texas Tech Univ., Lubbock (USA). Dept. of Electrical Engineering). 1 Dec 1981. 255p. NTIS, PC A12/MF A01.

Ten program elements related to pulsed power research are described. These program elements form a multi-disciplinary, coordinated program whose main emphasis is to gain improved understanding of high power, repetitive closing and opening switches. The main emphasis is concerned with triggering of discharges in gas filled spark gaps and the associated electrode erosion and insulator damage. Considerable efforts are also being made to understand the limitations and fundamental discharge phenomena in fast opening switches for inductive energy storage. A novel electromechanical pulse generator which promises to deliver fast, repetitive pulses to a load is also being investigated.

2505 Flywheels

REFER ALSO TO CITATION(S) 57771

57016 **Toward optimization of the woven flywheel.** Sapowith, A.D.; Handy, W.E. (Avco Syst Div, Wilmington, Mass, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1:** 881-886(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The constant stress composite flywheel described incorporates fibers in the two principal stress directions: radial and circumferential. A description of this design concept, along with two basic fabrication methods, is presented. The low cost fabrication approach which incorporates a spiral weave is evaluated for its energy storage capacity. 3 refs.

2506 Thermal

57017 **(SAND—82-1833C) Summary report of the study of single medium thermocline thermal-energy storage.** Gross, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 31p. (CONF-820827—5). NTIS, PC A03/MF A01. Order Number DE82020088.

From Energy storage contractors review meeting; Arlington, VA, USA (23 Aug 1982).

Experiments conducted on the 4.54 m^3 (1200) gal) engineering prototype thermocline tank at Sandia National Laboratories, Albuquerque (SNLA) are described. Heat loss tests showed that the maximum heat loss could be limited to 4.8% a day. An effective flow diffuser is presented in conjunction with an accurate method for predicting its pressure drop. Charge and discharge tests yielded sharp thermoclines over a broad flow rate range. The one-dimensional measured temperature distributions led to a one-dimensional predictive model which agreed well with static (no flow) thermocline degradation tests.

57018 **Two-dimensional model for thermal energy storage in a phase-changing material interacting with a heat-carrying fluid.** Grossman, G.; Pesotchinski, D. (Oak Ridge Natl Lab, TN). *American Society of Mechanical Engineers, [Paper];* No. 81-WA/HT-35, vp(Nov 1981).

The paper presents a two-dimensional model for melting (or solidification) of a phase-changing material (PCM) surrounding a pipe. A fluid flowing in the pipe is used as a carrier of heat from a distant source. A multitude of such pipes with a suitable PCM around them can serve as a heat storage unit for solar or other applications. The present model takes into consideration temperature variations in two dimensions. 9 refs.

57019 **Pelletization and roll encapsulation of thermal energy storage materials.** Chen, J. (Pennwalt Corp, King of Prussia, Pa, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1:** 931-934(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Seven phase change materials (PCMs) including inorganic salt hydrates and wax with melting points in the range suitable for either absorption cooling (85°C and above), active heating (35-60°C), or passive space conditioning (20-30°C) applications have been pressed into pellets about 12mm in diameter and then encapsulated with latex coating materials by a roll coating process. The objective of this effort is the development of reliable and cost effective PCMs. 7 refs.

57020 **Confined aquifer thermal energy storage: Mobile Doublet Experiment.** Molz, F.J.; Parr, A.D.; Melville, J.G. (Auburn Univ, Ala, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1:** 941-945(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The present paper discusses the preparation for a third set of experiments and results to date of the first injection-storage-recovery cycle utilizing a supply and injection well in the same aquifer. Such a configuration should minimize geochemical problems experienced during previous studies. 14 refs.

2508 Chemical

57021 **Comparative economics and energy consumption of chemical heat pumps and competitive systems.** Gorman, R.; Morite, P.S. (TRW, McLean, Va, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1:** 861-865(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Under contract to Brookhaven National Laboratory, TRW conducted a cost-effectiveness and energy resource evaluation of two chemical heat pump (CHP) concepts: a sulfuric acid-water CHP and a methanol-calcium chloride CHP. The CHPs were compared to baseline and emerging competitive technologies for providing space conditioning services to residential and commercial buildings and for upgrading industrial process heat. 4 refs.

2509 Batteries

REFER ALSO TO CITATION(S) 57289, 57290, 57748, 58224

57022 **(AD-A—110892/7) Electrochemical state models of lead-acid batteries.** Pfister, R.J. (Massachusetts Inst. of Tech., Cambridge (USA)). May 1979. 115p. NTIS, PC A06/MF A01.

Thesis.

In order to establish a model which would more accurately predict discharge characteristics of a cell at any arbitrary current, and which would better fit the family of discharge curves, testing was done based on the Shepherd equation using a transparent lead-acid battery. A set of dicharge curves at .6, 1.5, 3.6, and 5.4A, preceded by a 3.6A preconditioning discharge to remove the 'memory effect,' was obtained. The battery was cycled continuously through deep discharges in an attempt to determine secular changes during the life of the battery. Several modifications to the Shepherd equation were proposed in order to obtain a better fit to discharge data. These included modeling the capacity as a function of current as $Q=CI$ (1-n), Peukert's equation; modeling the ohmic polarization as a linear function of accumulated charge; and modeling the diffusion polarization as a function of accumulated charge alone and not current. Conclusions were drawn on the suitability of Shepherd's equation. The inclusion of the changed ohmic polarization term gave a good fit for individual curves which also suggested the change in the diffusion polarization term. Since a small current density approximation was used in Shepherd's equation, developing a model based on the original terms was recommended. Also recommended were the modification of a model to predict characteristics during a cycle with various discharge currents and further life cycle testing to determine the secular changes in the battery.

57023 **(AD-A—111087/3) Nickel-zinc batteries for RPV applications. Interim technical report, 15 December 1979-15 November 1980.** Dappert, D. (Eagle-Picher Co., Joplin, MO (USA)). Jun 1981. 70p. NTIS, PC A04/MF A01.

Interim results are presented for a program dealing with the placement of nickel-zinc batteries in specific military applications, namely the BQM-34A and the PQM-102 Remotely Piloted Vehicles. The nickel-zinc system was chosen for these applications because RPV's demand a high quality secondary battery that offers a compromise between long life (calendar and cycle) and low weight and volume. Program tasks include continued development of the nickel zinc system, calendar and cycle life testing of the two candidate batteries, qualification testing, and flight testing in operational RPV's. Test results of developmental cells and batteries include cycle life testing of various separator materials, high rate/low temperature discharges with various types of nickel electrodes, zinc electrode substrate, and charging methods. Calendar and cycle life testing is underway which will demonstrate the ability of the nickel-zinc system to be routinely cycled over an extended period of time.

57024 **(AD-A—111687/0) Impedance of aerospace NiCd cells under open circuit conditions. Interim rept.** Zimmerman, A.H. (Aerospace Corp., El Segundo, CA (USA)). 25 Jan 1982. 29p. NTIS, PC A03/MF A01.

The open circuit impedance of 10-A h sealed NiCd cells has been measured from 0 to 100,00 Hz as a function of cell state of charge and temperature. The open-circuit impedance at frequencies below 0.01 Hz is modeled by two consecutive diffusion-controlled charge transfer processes in the NiCd cell. Data analysis indicates that both solid-state diffusion processes and electrolyte diffusion processes are consistent with the data. Because concentration polarization is known to occur in NiCd cells, the two observed processes are tentatively assigned to electrolyte diffusion in the positive and negative plates. The resolution of these processes in the impedance spectrum is sensitive to the relative pore structure and morphology of the electrode plates.

57025 **(ATR—82(8459)-1) Electrochemical utilization of metal hydrides.** Bittner, H.F.; Badcock, C.C. (Aerospace Corp., El Segundo, CA (USA)). Apr 1982. 30p. NTIS, PC A03/MF A01.

The electrochemical utilization of metal hydrides is reviewed. Metal hydrides were investigated for hydrogen storage in nickel hydrogen batteries. The use of hydrides lowered the operating pressures in nickel hydrogen cells, which leads to improved energy density. Metal hydrides used as reversible hydrogen electrodes are discussed. Thermodynamic and kinetic investigations of a variety of hydriding materials are reviewed.

57026 **(NASA-TM—82802) Cross-linked polyvinyl alcohol films as alkaline battery separators.** Sheibley, D.W.; Manzo, M.A.; Gonzalez-Sanabria, O.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Mar 1982. 19p. (CONF-801067—; E—1141). NTIS, PC A02/MF A01.

From Lithium battery symposium; Hollywood, FL, USA (5 Oct 1980).

Cross-linking methods were investigated to determine their effect on the performance of polyvinyl alcohol (PVA) films as alkaline battery separators. The following types of cross-linked PVA films are discussed: (1) PVA-dialdehyde blends post-treated with an acid or acid periodate solution (two-step method) and (2) PVA-dialdehyde blends cross-linked during film formation (drying) by using a reagent with both aldehyde and acid functionality (one-step method). Laboratory samples of each cross-linked type of film were prepared and evaluated in standard separator screening tests. The pilot-plant batches of films were prepared and compared to measure differences due to the cross-linking method. The pilot-plant materials were then tested in nickel oxide - zinc cells to compare the two methods with respect to performance characteristics and cycle life. Cell test results are compared with those from tests with Celgard.

57027 **High capacity nickel battery material doped with alkali metal cations.** Jackovitz, J.F.; Pantier, E.A. (to Department Of Energy). US Patent 4,330,603. 18 May 1982. Filed date 29 Jan 1981. vp.

PAT-APPL-229360.

A high capacity battery material is made, consisting essentially of hydrated Ni(II) hydroxide, and about 5 wt. % to about 40 wt. % of Ni(IV) hydrated oxide interlayer doped with alkali metal cations selected from potassium, sodium and lithium cations.

57028 **Molten salt lithium cells.** Huggins, R.A.; Poris, J.; Raistrick, I.D. (to Department of Energy). US Patent 4,315,059. 9 Feb 1982. Filed date 18 Jul 1980. vp.

PAT-APPL-170254.

Lithium-based cells are promising for applications such as electric vehicles and load-leveling for power plants since lithium is very electropositive and light weight. One type of lithium-based cell utilizes a molten salt electrolyte and is operated in the temperature range of about 400*-500* C. Such high temperature operation accelerates corrosion problems and a substantial amount of energy is lost through heat transfer. The present invention provides an electrochemical cell (10) which may be operated at temperatures between about 100*-170* C. Cell (10) comprises an electrolyte (16), which preferably includes lithium nitrate, and a lithium or lithium alloy electrode (12).

57029 **Method for manufacturing an electrochemical cell.** Eshman, P.F.; Kaun, T.D. (to Department of Energy). US Patent 4,313,259. 2 Feb 1982. Filed date 9 May 1980. vp.

PAT-APPL-148325.

A secondary electrochemical cell is prepared by providing positive and negative electrodes having outer enclosures of rigid perforated electrically conductive material defining an internal compartment containing the electrode material in porous solid form. The electrodes are each immersed in molten electrolyte salt prior to cell assembly to incorporate the cell electrolyte. Following solidification of the electrolyte substantially throughout the porous volume of the electrode material, the electrodes are arranged in an alternating positive-negative array with interelectrode separators of porous frangible electrically insulative material. The completed array is assembled into the cell housing and sealed such that on heating the solidified electrolyte flows into the interelectrode separator.

57030 **Transient current distributions in porous zinc electrodes in KOH electrolyte.** Liu, M.B.; Cook, G.M.; Yao, N.P. (Argonne Natl Lab, Ill). *Journal of the Electrochemical Society;* **129**: No. 2, 239-246(Feb 1982).

Transient current distributions were measured in porous zinc electrodes at current densities from 24 to 240 mA/cm^2 in 7.24N KOH saturated with ZnO. The current distributions were highly nonuniform. The reaction penetration depth was initially about 0.015 cm and decreased gradually to about 0.008 cm at "steady state" The current distribution change occurring during passivation of the electrode was measured. The analysis of the experimental data indicates that the high nonuniformity of current distributions was due to high electrolyte resistance compared with both the charge-transfer resistance and the diffusion resistance of OH/sup -/ ions. A model incorporating a surface blockage mechanism by compact ZnO formation did not completely predict the observed passivation behavior of the electrode. 35 refs.

57031 **Current-induced composition gradients in molten AgNO/sub 3/-NaNO/sub 3/: a model system for the LiCl-KCL electrolyte of an Li/S battery.** Vallet, C.E.; Heatherly, D.E.; Sherman, R.L.; Braunstein, J. (Oak Ridge Natl Lab, Tenn, USA). *Journal of the Electrochemical Society;* **129**: No. 1, 49-55(Jan 1982).

Composition gradients, in molten AgNO/sub 3/-NaNO/sub 3/ mixtures contained in silica frits, are produced by electrolysis between silver electrodes and analyzed by three methods: (i) in situ potentiometry, (ii) chemical analysis of sections of quenched electrolyte, and (iii) scanning electron microscopy with associated x-ray fluorescence spectroscopy. The composition changes are calculated a priori from transport and thermodynamic properties independently measured in the free melt and corrected for the porosity of the frits. Since the ion flows in AgNO/sub 3/-NaNO/sub 3/ are analogous to those in the LiCl-KCl electrolyte of Li/S batteries, the former system serves as a convenient model system for the mixed electrolyte of the Li/S battery. The predicted gradients are compared to the experimental data from the three methods. 25 refs.

57032 **Electrochemistry of metal oxide additives in pasted zinc electrodes.** McBreen, J.; Gannon, E. (Brookhaven Natl Lab, Upton, NY). *Electrochimica Acta;* **26**: No. 10, 1439-1446(Oct 1981).

The effect of small additions (2 w/o-4 w/o) of HgO, Tl_2O_3, PbO, CdO, In_2O_3, $In(OH)_3$, In and Ga_2O_3 to pasted zinc oxide electrodes has been evaluated using chronopotentiometry, cyclic voltammetry, polarization measurements and scanning electron microscopy. Additives such as PbO, $In(OH)_3$ and In increase the density and the polarizability of the deposit whereas additives such as Ga_2O_3 and CdO yield finely divided deposits of low polarizability. The results are attributed to a substrate effect on zinc deposition. The beneficial effect of some additives (e.g., a mixture of 0.5w/o $In(OH)_3$ and 1 w/o PbO) is attributed to an improvement in the secondary current distribution due to an increase in electrode polarizability. 25 refs.

57033 **Polymer packaged cell in a sack.** McCartney, J.F.; Jones, T.E.; Johnson, L.I. (to Environmental Protection Agency). US Patent Application 258,838. 29 Apr 1981. 9p.

A battery cell and battery are disclosed in which a cathode layer and an anode layer are separated by a nonconducting ion permeable membrane and are sandwiched between a pair of conducting polymer layers. The conducting polymer layers and the ion permeable membrane form two distinct compartments in which the cathode and anode of the cell, respectively are positioned. A liquid electrolyte is sealed in each compartment. The ion permeable membrane allows passage through it of selected ions.

57034 **Method of enhancing the wettability of boron nitride for use as an electrochemical cell separator.** McCoy, L.R. (to Dept. of Energy). US Patent Application 228,002. 23 Jan 1981. 12p. Contract W-31-109-ENG-38.

Portions of document are illegible.

A felt or other fabric of boron nitride suitable for use as an interelectrode separator within an electrochemical cell is wetted with a solution containing a thermally decomposable organic salt of an alkaline earth metal. An aqueous solution of magnesium acetate is the preferred solution for this purpose. After wetting the boron nitride, the solution is dried by heating at a sufficiently low temperature to prevent rapid boiling and the creation of voids within the separator. The dried material is then calcined at an elevated temperature in excess of 400°C to provide a coating of an oxide of magnesium on the surface of the boron nitride fibers. A fabric or felt of boron nitride treated in this manner is easily wetted by molten electrolytic salts, such as the alkali metal halides or alkaline earth metal halides, that are used in high temperature, secondary electrochemical cells.

57035 **Thermal properties of LiAl/FeS batteries.** Gibbard, H.F.; Chen, D.M.; Chen, C.C.; Olszanski, T.W. (Gould Inc, Rolling Meadows, Ill, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 752-756(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The rate of thermal energy generation in 200-Ah LiAl/FeS cells was measured by two independent methods. The results of the thermodynamic calculations are in excellent agreement with the heat flow measured directly during cell discharge in a new isothermal conduction battery calorimeter. The results of a determination of the effective thermal conductivity of a cell are given, and measurements of the surface temperatures of cells in an operating 2.5-kWh battery are described. 11 refs.

57036 **Thermodynamics of alkaline battery systems.** Sundararaj, B.K.; Singh, R.P.; MacDonald, D.D. (Ohio State Univ, Columbus, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 658-662(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The thermodynamic properties of concentrated alkali electrolytes of the type which are employed in metal-alkali batteries are discussed. Emphasis has been placed on methods for determining the activities of the electrolyte and water as a function of concentration and temperature. 31 refs.

57037 **Electrochemical and morphological study of the effect of temperature on the restructuring and loss of capacity of alkaline battery electrodes.** Lenhart, S.J.; Chao, C.Y.; MacDonald, D.D. (Ohio State Univ, Columbus, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 663-666(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Alkaline battery electrode restructuring is being studied using ac impedance and ellipsometric techniques. Porous electrodes have been modeled as transmission lines, and the electrochemical properties (e.g., impedance and voltage drop in the pores) of the electrodes are being derived in terms of measurable physical properties. 5 refs.

57038 **Quick-charge feasibility of Li-Al/FeS batteries.** Farahat, M.M.; Chilenskas, A.A.; Barney, D.L. (Argonne Natl Lab, Ill, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 744-746(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

An investigation of the feasibility of rapidly recharging Li-Al/FeS batteries indicates that a significant range extension of electric vehicles can be accomplished with battery-capacity replacement of 75% in 3/4 hour. Three full-scale electric-vehicle battery cells were used in this study. 4 refs.

57039 **Calcium/iron disulfide secondary cells.** Preto, S.K.; Ross, L.E.; Otto, N.C.; Lomax, J.F.; Roche, M.F. (Argonne Natl Lab, Ill, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 765-768(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A Ca-Al/Si/FeS/sub 2/ cell which employs a molten LiCl-NaCl-CaCl/sub 2/-BaCl/sub 2/ electrolyte has been developed. A specific energy of 70 Wh/kg at the 5-h rate and a cycle life of 200 cycles have been achieved in bicell designs. At present, the cell life is limited by declining coulombic efficiency, and the cell power is limited by a gradual increase in cell resistance. 4 refs.

57040 **Effect of depth of discharge on cycle life of near-term batteries.** Seiger, H.N. (H.N. Seiger and Assoc). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 102-110(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The cycle life capability of most battery systems depends strongly on depth of discharge. This paper summarizes existing experimental results for lead-acid, nickel-zinc, and nickel-iron batteries, and analyzes the factors and mechanisms that impact cycle life. 35 refs.

57041 **Iron-air battery vehicle mission analysis.** Demczyk, B.G.; Ulerich, P.L.; Buzzelli, E.S. (Westinghouse Electr Corp, Pittsburgh, Pa, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 653-657(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A study was undertaken to determine compatability requirements of the Westinghouse iron-air battery propulsion system when utilized in various commuter electric vehicles. Both battery and vehicle size and weight parameters were adjusted to satisfy several defined vehicle missions. 6 refs.

57042 **Effects of constant-current/constant-voltage charge parameters on lead-acid traction cell performance.** Deluca, W.H.; Biwer, R.L.; Yao, N.P. (Argonne Natl Lab, Ill, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 674-679(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A factor described for the application of battery systems for electric vehicle propulsion is the methodology of charging. It was quantitatively determined that both the total charge cycle time and the maximum charging rate (constant-current level) are limited by battery charge acceptance. The test system and procedures are outlined, acquired battery parameter data presented, and conclusions discussed.

57043 **Ceramic separators for high-temperature lithium aluminum-iron sulfide batteries.** McCoy, L.R.; Saunders, R.C.; Heredy, L.A.; Sudar, S. (Rockwell Int, Canoga Park, Calif, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 747-751(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Lithium aluminum-iron sulfide batteries are being developed for electric utility offpeak energy storage and for electric vehicles. This paper presents the results of an experimental program in which an improved method of promoting the wetting of BN felt by the molten electrolyte was successfully tested and in which the preferred particle size range of MgO powders and their purity requirements were investigated. 5 refs.

57044 **Current-induced composition gradients in molten LiCl-KCl battery electrolytes.** Braustein, J.; Cantor, S.; Vallet, C.E. (Oak Ridge Natl Lab, Tenn, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 757-760(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Current induced composition gradients were demonstrated in molten LiCl-KCl eutectic mixture, the electrolyte of a LiAl/LiCl-KCl/FeS/sub x/ battery. Analysis of composition profiles in quenched samples was by atomic absorption spectroscopy (AA), which gave good precision, and by x-ray fluorescence spectroscopy in a scanning electron microscope (SEM/EDX), which gave good distance resolution. 5 refs.

57045 **Development of a solid state storage battery.** Rea, J.R.; Kelsey, G.S.; Kallianidis, M. (Duracell Int Inc, Burlington, Mass, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 761-764(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The totally solid state battery system Li-Si/LiI (Al/sub 2/ O/sub 3/)/metal sulfide is under investigation for energy storage applications, because of certain advantages in materials compatibility, efficiency, and simplicity that derive from the nature of a solid system. 6 refs.

57046 **Use of alkali nitrate molten salts as electrolytes in intermediate temperature lithium batteries.** Raistrick, I.D.; Poris, J.; Huggins, R.A. (Stanford Univ, Calif, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 774-778(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Advanced lithium batteries presently under development operate either at the high temperatures associated with the LiCl-KCl molten salt (350-450/degree/C), or at ambient temperatures employing organic solvent based electrolytes. An intermediate temperature lithium battery is proposed as an alternative if it reduces corrosion problems present at high temperatures and improved kinetic performance with respect to ambient temperature cells. 17 refs.

57047 **Performance of sodium-beta alumina solid electrolyte in Na/S cells.** De Jonghe, L.C. (Univ of Calif, Berkeley, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 826-829(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The performance of sodium-beta alumina type solid electrolytes is limited by degradation. Two different modes of degradation are discussed. Mode I involves the well studied current focusing on a pre-existing surface flaw; Mode II involves internal sodium precipitation and possible microfracture. The second mode can be activated when a gradient in transport number ratios has been created by chemical reduction of the electrolyte by the sodium electrode. The implications of the degradation for cell operation are discussed. 9 refs.

57048 **Prospect of advanced lead-acid, nickel/iron and nickel/zinc batteries for electric vehicle applications.** Yao, N.P.; Christianson, C.C.; Hornstra, F. (Argonne Natl Lab, Ill, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 641-644(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

One of the five projects of the EHV Division is the Electric Vehicle Project which has a goal of stimulating industry commercialization in 1986 of competitive electric commuter vehicle capable of a 100 mile urban range in stop-and-go driving. Improvements in battery, propulsion system and vehicle design are required to achieve the 100 mile range goal. Under contract from DOE, General Electric and Chrysler recently designed and fabricated an improved four-passenger Electric Test Vehicle (ETV-1) with low road and aerodynamic energy losses and an efficient propulsion system. 12 refs.

57049 **Evaluation of small sodium-sulfur batteries for load leveling.** Bridges, D.W.; Minck, R.W. (Ford Aerosp and Commun Corp, Newport Beach, Calif, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 830-835(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Eleven groups of from 24 to 64 cells were interconnected in parallel and operated as batteries. Data are reported for five representative batteries. Those comprised of Mark-IID cells proved to be fail-safe and maintainable: several groups were cooled to ambient after operating, refurbished, reheated, and operated again. 6 refs.

57050 **Small sodium-sulfur battery for solar and wind energy systems.** Haskins, H.J.; Domaszewicz, A.G. (Ford Aerosp and Commun Corp, Newport Beach, Calif, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 836-840(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A conceptual design of a 1 MWh sodium-sulfur storage battery is presented. The battery is intended for use in small (15 kW), stand-alone solar or wind electrical power systems. The design incorporates approximately 1400 sodium-sulfur cells of a new, high energy capacity configuration. 3 refs.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 57140, 57273

57051 **(DOE/CS/20174—T1) Urban energy officials: 1981 directory.** (US Conference of Mayors, Washington, DC). 1981. Contract FG01-79CS20174. 60p. NTIS, PC A04/MF A01. Order Number DE82016759.

State Energy Office contacts for 678 cities are listed. Entries are organized alphabetically by state. A separate list is included of Department of Energy area offices (formerly DOE Regional Offices).(MCW)

57052 **(INIS-mf—7109) Memorandum on the German energy policy.** (Verein Deutscher Ingenieure (VDI) - Gesellschaft Energietechnik, Duesseldorf (Germany, F.R.)). May 1981. 4p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82780644.

The present memorandum is addressing the political carriers of decisions and trying to enhance the development of certain lines of energy policy. For this purpose eight requirements are articulated which, in essential, aim at a secure energy supply policy independent of petroleum if possible.

57053 **(INIS-mf—7115) Twenty-ninth annual report 1980-81.** (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jan 1982. 164p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE82780645.

Contents include a review of the world energy situation; uranium resources, U3O8 production, conversion, enrichment reprocessing and waste disposal; details of Australian uranium deposits and their development; licensing and regulatory aspects; applications of radioisotopes and radiations, and an outline of research projects. Staff publications are also listed.

57054 **(NP—2902913) Directory of Indian organisations concerned with the promotion of the use of new and renewable sources of energy.** (Tata Energy Research Inst., Bombay (India). Documentation Centre). Jun 1981. 83p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82902913.

Portions of document are illegible.

Information is presented on about 100 organizations in India concerned with the promotion of the use of new and renewable sources of energy. The name and address of the firm, a contact person, type of project, and other pertinent information are included for government agencies, and research and information centers. (MCW)

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 57092, 57100, 57136, 57200

57055 **(DOE/EIA/08604—T1) NEIS conceptual design and implementation plan: executive summary. Final report.** Fiorello, M.; Shaw, M. (Logistics Management Inst., Washington, DC (USA)). May 1978. Contract AC01-78EI08604. 21p. NTIS, PC A02/MF A01. Order Number DE82014378.

Portions of document are illegible.

The purpose of the National Energy Information System (NEIS) is to assure the availability of accurate and credible energy information to government agencies responsible for energy-related policy decisions, the Congress, and the public. NEIS is chartered to: correct the problems of inaccurate, incompatible, redundant and unavailable energy data; provide a central location for accessing and controlling required data; and utilize existing data systems to the maximum extent feasible. The conceptual design and implementation plan for NEIS to achieve its charter are summarized. The fundamental parts of the design are presented. The NEIS goals are reviewed and are related to the design of the NEIS interval function, its content, hardware configuration, and implementation strategy. An implementation plan to develop a first increment for NEIS is presented.

57056 **(DOE/EIA/08604—T2) National Energy Information System: Implementation plan. Final report.** Fiorello, M.; Farquhar, J.; Lutz, M.; Shaw, M. (Logistics Management Inst., Washington, DC (USA)). May 1978. Contract AC01-78EI08604. 118p. NTIS, PC A06/MF A01. Order Number DE82014370.

Portions of document are illegible.

An implementation plan to develop and operate the initial increment (module 1) of the National Energy Information System (NEIS) is described. Module 1 implementation must satisfy two partially contradictory objectives. First, it must be carried out as rapidly as possible. Second, Module 1 development should preclude a minimum of the long-term NEIS design options. This implementation plan balances these requirements by first carrying out a user needs survey and providing a baseline design for the full NEIS. The scope of implementation activity is successively narrowed, through functional design and development, to produce only Module 1 of NEIS. The six Activity Classes that comprise the implementation plan are discussed in detail. The technical approach and the philosophy, objectives, and methods underlying the chosen implementation strategy are discussed. An aggregate activity schedule is displayed; development costs are summarized; and implementation issues are discussed. (MCW)

57057 **(DOE/EIA/08604—T3) National Energy Information System: Detailed conceptual design.** Fiorello, M.; Lutz, M.; Morris, S.; Shaw, M. (Logistics Management Inst., Washington, DC (USA)). May 1978. Contract AC01-78EI08604. 218p. NTIS, PC A10/MF A01. Order Number DE82014368.

Portions of document are illegible.

The conceptual design of the National Enrgy Information System (NEIS) is presented. The existing energy data situation is reviewed and the basic approach to the design of NEIS is explained. The NEIS goals are analyzed and the NEIS user requirements in terms of information content, system functions, and operational requirements are defined. Alternative design strategies are analyzed as a means of establishing the scope of NEIS. The organizational implementation of the NEIS charter is discussed. Four representative hardware configurations are presented and some preliminary recommendations for the NEIS configuration are made. The NEIS implementation plan is summarized. Back-up material illustrations, and references are contained in appendices. (MCW)

57058 **(EUR—7781-FR) European energy model: evaluation of the medium-term energy-demand case study - France, 1980.** Degueurce, M.; Labrousse, M. (Commissariat a l'Energie Atomique, Brussels (Belgium)). 1982. 52p. (In French). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The energy model designed to evaluate the medium term energy demand, developed by the EEC Commission (DG XII) is composed of three econometric models: EURECA (a multinational model), EXPLOR and EDM (national models). This report describes the philosophy of each one of the models and also the macroeconomic, sectorial and energy datas which have been collected for the French case study and the results expected for 1990. The study is based on two different hypotheses for the price of imported energy commodities: stability and an annual 5% increase in real terms. The results are contrasted with the forecasts made for France within the frame of the VIIIth Plan and modifications are suggested which could improve the validity of this set of models.

57059 **(PB—82-180274) Energy laboratory data and model directory. Final report.** Lahiri, S.; Carson, J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jul 1981. 180p. (MIT-EL—81-025). NTIS, PC A09/MF A01.

Over the past several years M.I.T. faculty, staff, and students have produced a substantial body of research and analysis relating to the production, conversion, and use of energy in domestic and international markets. Much of this research takes the form of models and associated data bases that have enduring value in policy studies (models) and in supporting related research and modeling efforts (data). For such models and data it is important to ensure that the useful life cycle does not end with the conclusion of the research project. This directory is an important step in extending the usefulness of models and data bases available at the M.I.T. Energy Laboratory. It will be updated from time to time to include new models and data bases that have been developed, or significant changes that have occurred.

57060 **Energy for agriculture in Pakistan.** Jameel, M. Laxenburg, Austria; International Institute for Applied Systems Analysis (1982). 38p. (IIASA-RR—82-20). International Inst. for Applied Systems Analysis, A-2361, Laxenburg, Austria.

Energy use in agriculture at present is analyzed and its evolution is projected to the year 2000. The perception of future is aided by a scenario approach: three different development paths for farm mechanization and two for the supply of macronutrients are considered. The energy implications of each future are examined in detail. The results show that the present expenditure of commercial energy goes almost entirely into the production of fertilizers and for irrigation/drainage, the former accounting for approximately 45%, and the latter for 40% of total primary energy input to agriculture; the remainder is shared by tractors, threshers and pesticides. For the year 2000, energy data for the different scenarios are presented, but the major share will again be taken by fertilizers, followed by irrigation and drainage. The greatest savings in energy are therefore also to be effected if the use of chemical fertilizers is reduced, and if water resources are conserved. These measures should however be taken in ways that do not adversely affect agricultural productivity.

57061 **Energy demand models based on the translog and CES functions.** Reister, D.B.; Edmonds, J.A. (Oak Ridge Associated Universities, Tenn). *Energy (Oxford);* 6: No. 9, 917-926(Sep 1981).

The therory of production is a well-developed branch of economics which provides a solid foundation for energy-demand models. Use of the theory requires the architect of the model to make a choice of a function from a large family of possible functions. This step, which is called model specification, is seldom discussed in the literature. In this paper, are contrasted the properties of two popular choices: the translog function and the constant elasticity of substitution (CES) function. The translog function is a flexible form but does not have good global properties. The CES function has good global properties but is not a flexible form. For energy demand models that should be valid in a large domain, global properties are important. The translog function provides a second-order approximation to the cost function, a first-order approximation to the factor share, and a zero-order approximation to the price elasticities of demand. If the translog function is used to forecast the response to a large price change, the forecast may have a significant error. 13 refs.

57062 **Dynamic linear programming models of energy, resource, and economic-development systems.** Propoi, A.; Zimin, I. *IIASA Reports;* 3: No. 2, 407-474(Apr-Jun 1981).

This report develops a unified dynamic linear programming approach to studying long-range development alternatives in the energy sector. With the demand for energy and the supply of nonenergy resources needed to develop the energy supply system given exogenously, the report first seeks the optimal mix, phased over time, of different energy technologies. Next, it considers the problem of finding, for primary energy resources, the optimal mix over time of different exploration and extraction technologies. The third part of the report uses an optimization version of a dynamic input-output model to study the macroeconomic impacts of the energy sector. Finally, the report discusses the interactions among these models, presents a general dynamic linear programming framework, and takes up some related methodological issues.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 56906, 57100, 57128, 57129

57063 **(LBL—14686) Supply curves of conserved energy.** Meier, A.K. (Lawrence Berkeley Lab., CA (USA)). May 1982. Contract AC03-76SF00098. 121p. NTIS, PC A06/MF A01. Order Number DE82020066.

Thesis.

Supply curves of conserved energy provide an accounting framework that expresses the potential for energy conservation. The economic worthiness of a conservation measure is expressed in terms of the cost of conserved energy, and a measure is considered economical when the cost of conserved energy is less than the price of the energy it replaces. A supply curve of conserved energy is independent of energy prices; however, the economical reserves of conserved energy will depend on energy prices. Double-counting of energy savings and error propagation are common problems when estimating conservation potentials, but supply curves minimize these difficulties and make their consequences predictable. The sensitivity of the cost of conserved energy is examined, as are variations in the optimal investment strategy in response to changes in inputs. Guidelines are presented for predicting the consequences of such changes. The conservation supply curve concept can be applied to peak power, water, pollution, and other markets where consumers demand a service rather than a particular good.

57064 **(NUREG/CR—2088) A literature review of occupational licensing applied to industrial radiography. Technical report.** Turnage, J.J. (University of Central Florida, Orlando (USA)). Feb 1982. 35p. NTIS, PC A03/MF A01.

This report summarizes the literature on the licensing of individuals in various occupations to determine whether licensing of individual radiographers might improve safety performance and reduce radiation overexposures. The review discusses: (1) previous NRC considerations of licensing radiographers; (2) the literature on occupational licensing; (3) studies of factors that relate to good safety records; and (4) experiences from the NRC's reactor operator licensing program. Findings are applied to the possible licensing of industrial radiographers. The review concludes that licensing may be a means to assure adequate safety training for radiographers, but it is unlikely that licensing will improve a radiographer's motivation to perform safely. Improved regulation of management may be the most effective means of assuring safety.

57065 **Changes in comparative advantages and paths of structural adjustment and growth in Sweden, 1975-2000.** Bergman, L.; Ohlsson, L. *IIASA Reports;* 3: No. 2, 375-405(Apr-Jun 1981).

The purpose of this study is to identify possible future development paths for the Swedish economy in a context where world market conditions, domestic factor accumulation, and technical change are explicitly taken into account. The main analytical tool used in the study is a general equilibrium model of the Swedish economy. World market prices and trade flows as well as domestic factor accumulation and productivity change are exogenous to the model. The sectoral allocation of capital and labor as well as domestic consumption, foreign trade, and the domestic price system are endogenously determined variables. The study's projections indicate that Sweden is entering a period of considerably slower economic growth than occurred during the earlier part of the postwar period. Underlying this result is an assumed slowdown of the productivity growth rate. The assumed rates of productivity change do not differ significantly between the sectors. Consequently, reallocation gains can be achieved mainly through a reduction of the intersectoral differences in the marginal productivity of capital, characterizing the initial year of the projection period.

57066 **1981 transactions of the American Association of Cost Engineers.** Morgantown, WV; American Association of Cost Engineers (1981). 500p. (CONF-8106223—). American Association of Cost Engineers, 308 Monongahela Building, Morgantown, WV 26505.

From 25. American Association of Cost Engineers annual meeting; Toronto, Ontario, Canada (28 Jun 1981).

A separate abstract was prepared for eleven of the seventy-five papers included in the transactions.

57067 **Economic evaluation of energy projects.** Humphreys, K.K. (West Virginia Univ., Morgantown); Simcoe, E.J.; McMillan, B.G.; Alderman, J.K. *Transactions of the American Association of Cost Engineers;* M.5.1-M.5.8(1981). (CONF-8106223—).

From 25. American Association of Cost Engineers annual meeting; Toronto, Ontario, Canada (28 Jun 1981).

The development of guidelines to compare various technological alternatives is underway. Standards that will probably be used to define terms and codes which will be adopted to establish the economic evaluations are noted.

57068 **1979 transactions of the American Association of Cost Engineers.** Morgantown, WV; American Association of Cost Engineers (1979). 440p. (CONF-790715—). American Association of Cost Engineers, 308 Monongahela Building, Morgantown, WV 26505.

From 23. annual meeting of the American Association of Cost Engineers; Cincinnati, OH, USA (15 Jul 1979).

Separate abstracts were prepared for eight of the sixty-four papers included in the transactions.

57069 **Energy: social and political aspects.** Patton, F.S. (Union Carbide Corp. Nuclear Division, Oak Ridge, TN). *Transactions of the American Association of Cost Engineers;* K.2.1-K.2.8(1979). (CONF-790715—).

From 23. annual meeting of the American Association of Cost Engineers; Cincinnati, OH, USA (15 Jul 1979).

The grouping of the countries of the world according to their political and economic characteristics has become commonplace. The groupings are described. The high living standards of the First World are detailed. Energy factors resulting from the prominent use of petroleum are summarized.

57070 **1978 transactions of the American Association of Cost Engineers.** Morgantown, WV; American Association of Cost Engineers (1978). 452p. (CONF-780710—). American Association of Cost Engineers, 308 Monongahela Building, Morgantown, WV 26505.

From 22. American Association of Cost Engineers meeting; San Francisco, CA, USA (9 Jul 1978).

Separate abstracts were prepared for eighteen of the eighty-four papers included in the transactions.

57071 **1977 transactions of the American Association of Cost Engineers.** Morgantown, WV; American Association of Cost Engineers (1977). 415p. (CONF-770631—). American Association of Cost Engineers, 308 Monongahela Building, Morgantown, WV 26505.

From 21. American Association of Cost Engineers annual meeting; Milwaukee, WI, USA (26 Jun 1977).

Separate abstracts were prepared for nine of the seventy-two papers included in the transactions.

57072 **Computerized cost estimates and their inherent error.** DeLozier, R.C. (Union Carbide Corp., Oak Ridge, TN). *Transactions of the American Association of Cost Engineers;* 303-308(1977). (CONF-770631—).

From 21. American Association of Cost Engineers annual meeting; Milwaukee, WI, USA (26 Jun 1977).

The Union Carbide Corporation-Nuclear Division at Oak Ridge, Tennessee, has responsibility for design, cost estimating and project management of several new facilities and capital improvements in the multibillion dollar range. The size of these projects has prompted the in-house development of computerized estimating programs over the past decade. These cost estimating programs fall into two distinct categories: conceptual and detailed. The detailed types require data or costs arrived at from design drawings and detailed subproject schedules. In contrast, the CONCEPT program uses data bases which are, in general, costs that have been observed on past projects, or at least estimated costs and schedules that are assembled at a relatively high level of aggregation. The CONCEPT program was developed to estimate the capital costs associated with nuclear and fossil fueled power plants. However, the program has been used in the last few years for estimating costs of other large construction projects. This program was selected for Monte Carlo analysis because the data base is smaller than the more detailed codes and the user input is somewhat more simple. It is felt that the evaluation of inherent error using the CONCEPT program is applicable to detailed types of computerized cost estimating and, furthermore, resulting time savings make it a more desirable choice even if the data base must be converted from the ECON type to the CONCEPT type.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 56052, 56643, 57079, 57096, 57117, 57129, 57227, 57285, 58122, 58123, 58137, 58142, 58179, 58180, 58182

57073 **(AD-A—111556/7) Federal government should encourage early public, regulatory, and industry cooperation in siting energy facilities.** (Vermont Univ., Burlington (USA). Dept. of Physics). 13 Nov 1981. 56p. NTIS, PC A04/MF A01.

Efforts to expand domestic production of coal, synthetic fuels, and other energy sources have fallen behind expectations. One reason has been the inability to effectively identify acceptable sites for energy facilities--reconciling the conflicts between the need for domestic energy development, and the need to protect the environment and the public's voice in decision making. Recent experience shows, however, that early and active involvement by regulatory agencies and the public in finding sites for new energy facilities can prevent or alleviate costly, last-minute conflicts industry frequently encounters in choosing sites on its own. In this report, GAO discusses this promising 'open site planning' concept, analyzes why it is not used more frequently, and recommends actions the Federal Government can take to encourage its use.

57074 **(ATR—81(8376)-1) Military hazardous wastes: an overview and analysis.** Kawaoka, K.E.; Malloy, M.C.; Dever, G.L.; Weinberger, L.P. (Aerospace Corp., Germantown, MD (USA). Eastern Technical Div.). Dec 1981. 144p. NTIS, PC A07/MF A01. Order Number DE82902502.

Portions of document are illegible.

The report describes and analyzes the management activities and motivating factors of the military in dealing with its hazardous waste streams. Findings and conclusions in areas of concern are given to provide information that may be of value to the future management of military hazardous wastes.

57075 **(PB—82-189671) Energy impact delivery of health services by hospitals in northeastern states. Final report.** Marshall, G.B.; Glavin, R.G. (Human Resources Management Co., Washington, DC (USA)). Jun 1981. 202p. NTIS, PC A10/MF A01.

The study was conceptualized as both a data collection and analysis effort. It was undertaken through a detailed study of the experiences of nine acute care facilities and their communities over a period of four winters, 1977-78 through 1980-81. By collecting existing factual data about the communities, their Health Systems Agencies, and the selected institutions, objective profiles of the sites were prepared. To these were added comprehensive energy usage, consumption, conservation, and availability data. Subjective data about individual and institutional perceptions, awareness, and plans regarding energy impacts were collected through personal interviews with hospital personnel, community residents, and Health Systems Agency staff.

57076 **Improving the energy facility siting and permitting process.** Wellborn, S.; Williams, T. (DOE). pp 136-152 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

There have been several pieces of legislation introduced aimed at expediting the permitting process for new energy facilities. Recognizing the urgency of the situation, DOE is currently exploring several new approaches which may contribute to bringing new facilities on-line with a minimum of cost and delay. 8 refs.

2904 Natural Resources

REFER ALSO TO CITATION(S) 56061, 56412, 57066, 57068, 57070, 57071, 57093, 57101, 57102, 57103, 57104, 57105, 57106, 57107

57077 **(AD-A—110269/8) Grand Forks - East Grand Forks Urban Water Resources Study. Energy conservation and recreation appendix, public involvement appendix. Final report.** (Corps of Engineers, St. Paul, MN (USA). St. Paul District). Jul 1981. 94p. NTIS, PC A05/MF A01.

The goal of the Corps of Engineers Urban Study Program is to provide planning assistance to local interests in a variety of water resource areas. The St. Paul District conducted the Grand Forks-East Grand Forks (GF/EGF) Urban Water Resources Study which was a cooperative effort among local, state and federal agencies. Primary attention was given to flood control, water supply and wastewater management; supporting investigations addressed recreation and energy conservation. The recreation investigation consists of the leisure time analysis conducted in stage 2 of the urban study by the Heritage Conservation and Recreation Service, Department of the Interior. The leisure time analysis compared the study area's recreational needs to the available and planned facilities and identified unsatisfied needs. The thermography investigation was conducted in spring 1978 in response to the public's growing awareness of energy conservation and the Corps' desire to make the public aware of the urban study in a meaningful, useful fashion. The investigation consisted of aerial infrared photography, public displays of photographs, and distribution of information on energy saving practices. This investigation was a one-time effort with no plans for follow-up.

57078 (AD-A—110485/0) Impediments to US involvement in deep ocean mining can be overcome. (Vermont Univ., Burlington (USA). Dept. of Physics). 3 Feb 1982. 68p. (GAO/EMD—82-31). NTIS, PC A04/MF A01.

The abundant resources on the deep seabed could help relieve the Nation's almost total reliance on foreign sources for certain critical minerals. The 1980 Deep Seabed Hard Mineral Resources Act was passed to facilitate U.S. involvement in developing the seabed mineral resources. At present, however, continued U.S. involvement is quite uncertain. The uncertainty stems from strong opposition, from the mining industry and others, to many of the mining provisions in the United Nations' current draft Law of the Sea Treaty which would govern deep seabed mining in international waters. In this report, GAO reviews the implementation of the 1980 act; and analyzes the major impediments to U.S. involvement in deep seabed mining, particularly as they relate to the draft Law of the Sea Treaty, and offers recommendations to the Congress to overcome them.

57079 (PB—82-15333-9) Prospects for ground-water irrigation: declining levels and rising energy costs. Sloggett, G. (Economic Research Service, Washington, DC (USA). Natural Resource Economics Div.). Dec 1981. 49p. NTIS.

Ground water, an irreplaceable resource tapped from underground reservoirs, is decreasing in 11 major irrigating States. Pumping from greater depths will add to irrigation fuel costs, but rising energy prices will likely be a more serious constraint to expanded ground-water irrigation. Declining ground-water levels may not significantly reduce the irrigated area in the United States until well into the next century.

57080 (PB—82-162496) Nonstructural alternatives to hydroelectric power. Willey, W.R.Z. (Water Resources Council, Washington, DC (USA)). Feb 1981. 70p. NTIS, PC A04/MF A01.

The purpose of this document is to provide field level water resource planners with guidance in identifying and formulating nonstructural options.

57081 Kenyan agriculture: toward 2000. McCarthy, F.D.; Mwangi, W.M. Laxenburg, Austria; International Institute for Applied Systems Analysis (1982). 93p. (IIASA-RR—82-19). International Inst. for Applied Systems Analysis, A-2361, Laxenburg, Austria.

This study suggests that Kenya agricultural supplies will be adequate to meet domestic demands for maize, millet, sorghum, potatoes, fruit, and vegetables. There are possible shortfalls for wheat, rice, meat, and oils. The wheat supply can be augmented by a modest shift in policy, while meat will most likely require significantly higher producer and consumer prices. Barring a major policy shift, Kenya will need to import rice (about 60 tons per year) and oils. Kenya will still have significant surpluses of its traditional export crops, coffee and tea, and, with a continuation of present policies, a similar surplus for sugar. This overall consumption-production balance should be achievable with some increases in investment, particularly for improved marketing and distribution facilities, together with land improvement, together with incentives to encourage the move toward higher yields and improved technology. The burden on the balance of payments will not be disproportionately large.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 56221, 56973

57082 (PB—82-169731) The planning and management of energy-related research and development in the U.S.S.R.: science policy working group joint U.S.-U.S.S.R. science and technology exchange program. Final report. Campbell, R.W.; Esselman, W.H.; Gustafson, T.E.; Holley, C.E. (SRI International, Arlington, VA (USA). Strategic Studies Center). Sep 1980. 67p. (SSC-TN—7557-6). NTIS, PC A04/MF A01.

This is a combined report based on the notes of members of a four-person US team of specialists on energy-related RandD who visited the USSR in October 1979 under the auspices of the US-USSR Science Policy Working Group. The purpose of the visit was to study the organization, management, and development in Soviet energy RandD institutions. The team had discussions at the Czerzhinskiy All-Union Research Institute for Heat Engineering, the Krzhizhanovskiy Institute of Power Engineering, the All-Union Scientific Research Institute for Electrical Machine-Building, the Scientific Research Institute of Direct Current, the All-Union Scientific Research Institute for Hydraulic Engineering, and the Leningrad Electro-Technical Production Association (Eelektrosila).

57083 (TRITA-TFY—82-1) Annual report 1981. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Teoretisk Fysik). Jan 1982. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702221.

The research activities during 1981 are described. Project were going on in the following fields: Theoretical nuclear physics; particle physics; field theory and mathematical physics; theoretical biophysics; and theory of metals. A short abstract is given for each project.

57084 (UTNL-R—0095) Report of the research results with University of Tokyo, Nuclear Engineering Research Laboratory's Facilities in fiscal 1979. (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). 1980. 167p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82702220.

The common utilization of the fast neutron source reactor "Yayoi" in the University of Tokyo has been continued for nine years, and many results have been obtained. As for the linac, the common utilization was commenced in the last fiscal year. 1663 men utilized the reactor, and 1063 men utilized the linac in 1979. At present, the on-pile researches centering around these two large installations and the off-pile researches toward new large-scale ones are two pillars. It is delightful to collect universal knowledge in the form of the common utilization, to promote researches effectively and to feed the results of researches back to education. Now the learning is devided finely, and the fields in which solution requires the concentration of the expertises in various fields have increased, accordingly the importance of such common utilization has grown more and more. In the common utilization of the reactors, many results were obtained in the researches on the utilization of fast neutron irradiation, the irradiation for medical use, shielding, nuclear fusion neutronics and so on. In the experiments using the linac, the number of the themes is too much, and the machine time allotted to respective themes is very much in short. The night operation system was adopted to ease the situation. Picosecond pulse radiolysis, pulse irradiation in gas, liquid and solid phases, and TOF experiment produced the results.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 56279, 56280, 56375, 56411, 56412, 56771, *56890, 56906, 56973, 56974, 57093, 57114, 59011*

57085 **(INIS-mf—7101) Nuclear power at Ontario Hydro. A case study in technological innovation.** Tapon, F.; Osborne, T.J. (Ontario Economic Council, Toronto (Canada)). 1980. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780711.

This case study shows that the diffusion of nuclear power in the electric public utility industry in Canada approximates the logistic growth curve, in agreement with previous results on technological innovation diffusion in the U.S. private sector. Many of the economic variables that affect this diffusion in the private sectors in the U.S. and Canada are also significant in the public sector in Canada. Too few utilities have adopted nuclear technology to permit using regression analysis to study the effect of environmental and regulatory factors on the growth of Ontario Hydro. Thus, cost-benefit analysis for each province might be more effective.

57086 **(LA—9039) Nuclear power in the Soviet Bloc.** Davey, W.G. (Los Alamos National Lab., NM (USA)). Mar 1982. 60p. NTIS, PC A04/MF A01. Order Number DE82015079.

The growth of Soviet Bloc nuclear power generation to the end of the century is evaluated on the basis of policy statements of objectives, past and current nuclear power plant construction, and trends in the potential for future construction. Central to this study is a detailed examination of individual reactor construction and site development that provides specific performance data not given elsewhere. A major commitment to nuclear power is abundantly clear and an expansion of ten times in nuclear electric generation is estimated between 1980 and 2000. This rate of growth is likely to have significant impact upon the total energy economy of the Soviet Bloc including lessening demands for use of coal, oil, and gas for electricity generation.

57087 **(PNL—3570) Understanding radioactive waste.** Murray, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1981. Contract AC06-76RL01830. 116p. NTIS, PC A06/MF A01. Order Number DE82007628.

Portions of document are illegible.

This document contains information on all aspects of radioactive wastes. Facts are presented about radioactive wastes simply, clearly and in an unbiased manner which makes the information readily accessible to the interested public. The contents are as follows: questions and concerns about wastes; atoms and chemistry; radioactivity; kinds of radiation; biological effects of radiation; radiation standards and protection; fission and fission products; the Manhattan Project; defense and development; uses of isotopes and radiation; classification of wastes; spent fuels from nuclear reactors; storage of spent fuel; reprocessing, recycling, and resources; uranium mill tailings; low-level wastes; transportation; methods of handling high-level nuclear wastes; project salt vault; multiple barrier approach; research on waste isolation; legal requiremnts; the national waste management program; societal aspects of radioactive wastes; perspectives; glossary; appendix A (scientific American articles); appendix B (reference material on wastes). (ATT)

2907 Transport And Storage

REFER ALSO TO CITATION(S) 57296

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 57158, 57159, 57240, 57266, 57267, 57275

57088 **(CONF-820386—Summ.) Cogeneration: making it happen.** (National Economic Research Associates, New York (USA)). 18 Mar 1982. 11p. NTIS, PC A02/MF A01. Order Number DE82905228.

From NERA seminar cogeneration: making it happen; New York, NY, USA (18 Mar 1982).

A key point made at a recent NERA seminar entitled Congeneration: Making It Happen was that although pending litigation on two federal rules regarding cogeneration under PURPA has created uncertainty, the cogeneration rules remain in force. In addition, at the state level, PURPA-type laws that encourage cogeneration facilities are not affected by the litigation and are now being implemented. Other points made at the NERA seminar were that: (1) Cogenerators should tell regulators at both the commissioner and staff level what is needed to stimulate cogeneration activity; (2) Utilities and regulators support cogeneration, but implementation is slow and time consuming; (3) Cogenerators should not be reluctant to contact top management of utilities to discuss their proposals and ideas; (4) Cogenerators should become knowledgeable about the utility's needs and plans; (5) Cogenerators are concerned about project financing, environmental constraints, price regulation and lack of expertise with solid fuels; (6) Utilities are concerned about the effect of cogeneration on their ratepayers and on system reliability and safety; (7) Larger cogenerators should tailor their contracts to their own needs and avoid standard utility contracts; and (8) Cogenerators should work with consultants who are familiar with utility plans, operations and regulation.

2910 Conservation

REFER ALSO TO CITATION(S) 56327, 57115, 57132, 57138, 57179, 57180, 57185, 57186, 57189, 57197, 57202, 57211

57089 **(NP—2903705) Role of state government in energy conservation. Public hearing before Energy Conservation Subcommittee of the Assembly Energy and Natural Resources Committee.** (New Jersey General Assembly Energy and Natural Resources Committee, Trenton (USA)). 1981. 96p. NTIS (US Sales Only). Order Number DE82903705.

Portions of document are illegible.

Progress and a review of energy conservation projects being conducted in New Jersey are examined in testimony delivered at the hearings. The New Jersey Master Plan was explained. Implementation of the energy conservation strategy was emphasized. It is estimated that in 1980, implementation of conservation programs resulted in the savings of 77 trillion Btu. Highlights of the program for the coming year and the financial and budget concerns for the operation of the program are described. The effects of escalating inflation and high energy costs on the budgets of medium and low income groups is detailed by a representative from the Department of Human Services. A representative from the Department of Public Advocate spoke on the pricing of electricity, the need to phase out resistance heating; and the need to remove the barriers to the implementation of cogeneration and alternate power technologies in the state of New Jersey. Energy conservation activities of the New Jersey Board of Public Utilities are summarized and plans for the immediate future are outlined. Programs formulated and implemented by the Department of Education are described in testimony presented. (MCW)

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 56078, 56108, 56155, 56181, 57069

57090 **(AD-A—109182/6) An overview of Army Mobility Energy Research and Development. Interim report Jun 79-Oct 81.** Stavinoha, L.L.; Cauldwell, G.S.; Kemp, M.B. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Oct 1981. 82p. (AFLRL—146). NTIS, PC A05/MF A01.

Dependence on foreign oil sources and the attendant strategic problems of securing the long lines of supplies from possible interruption raise a question of the ability of the Armed Forces to carry out its mission in the event of a national emergency. Energy is essential for the Army in maintaining readiness to assure national security in peacetime, crisis, or war. The Army Energy Plan, which is in concert with and support of national energy goals, establishes the basis for reducing energy consumption, reducing dependency on conventional hydrocarbon fuels, and tasks the Army to obtain a position of energy leadership. In this report, the Department of Army Energy goals/objectives are identified and the framework for planning Army Mobility/Energy/Research and Development is outlined. Key elements of the Army Mobility Energy R and D plan of action include an organization plan, technical assessment, technical performance plan, and a management plan. The Army Mobility Energy R and D Program has been categorized into four program areas--fuels, other fluids, engines, and other equipment. Examples of individual projects, as well as an overview of the Army's Mobility Energy Research and Development are provided with respect to meeting Army Energy goals.

57091 **(AD-A—110536/0) Energy situation and the world of Californians.** Morrison, P.A. (RAND Corp., Santa Monica, CA (USA)). Aug 1981. 13p. NTIS, PC A02/MF A01.

57092 **(DOE/EIA/08604—T4) Requirements analysis for the Energy Emergency Management Information System.** Fiorello, M.; Farquhar, J.; Lutz, M.; Shaw, M. (Logistics Management Inst., Washington, DC (USA)). Dec 1978. Contract AC01-78EI08604. 183p. NTIS, PC A09/MF A01. Order Number DE82014369.

Portions of document are illegible.

The objective of the Energy Emergency Management Information System (EEMIS) is effective detection and prevention or management of energy emergencies. The user requirements for EEMIS from which a system design can be derived are described. These requirements fall into three categories: capabilities EEMIS should possess, services it should provide, and data and output it should collect and produce. In addition to specifying EEMIS user requirements, also presented is framework for evaluating candidate designs and the relative priorities of EEMIS implementation requirements.

57093 **(NP—2906080) Marketable energy resources in Alabama: a partially annotated research bibliography.** (Alabama Office of State Planning and Federal Programs, Montgomery (USA). State Planning Div.). Apr 1982. 71p. Office of State Planning and Federal Programs, State Planning Div., 3734 Atlanta Hwy., Montgomery, AL 36130 $6.00.

This bibliography has been compiled to provide a guide to the published research, both basic and applied, on the commercial potential and possible energy contribution of selected domestic renewable and non-renewable energy resources in Alabama. Some of the renewable and non-renewable energy resources documented in published form and highlighted in this bibliography include coal, oil, small-scale hydroelectric power, natural gas, wind energy, waste wood, and uranium. Citations dealing mainly with solar energy can be obtained by contacting organizations involved in the development of solar energy. The information for this publication was derived from a number of sources; including the Geological Survey of Alabama, Office of State Planning and Federal Program's Planning Reference Service, US Department of Energy's Technical Information Center at Oak Ridge, Tennessee, School of Mines and Energy Development of the University of Alabama, Mineral Resources Institute and State Mine Experiment Station of the University of Alabama. Each citation is complete insofar as the information was available to the compiler. Most abstracts contain some summary information on uses, technology, and economics. These summaries are not meant to be exhaustive. Users of the bibliography should deal directly with the Technical Information Center, US Department of Energy, PO Box 62, Oak Ridge, Tennessee 37830, or the supporting organization or project investigator as to the availability of copies of completed projects in report or book form. (PSB)

57094 **Evolution of future energy demands untill 2030 in different world regions: an assessment made for the two IIASA scenarios.** Khan, A.M.; Hoelzl, A. Laxenburg, Austria; International Institute for Applied Systems Analysis (1982). 137p. (IIASA-RR—82-14). International Institute for Applied Analysis, 2361-Laxenburg, Austria.

This assessment covers six of the seven world regions considered in the recently completed global study of IIASA's Energy Systems Program. MEDEE-2 was used to project the medium- to long-term energy demand at the level of world regions. This approach analyzes the base year energy demand for different sectors in terms of useful/final energy requirements for a large number of activities in each sector, and then projects for later periods by identifying the plausible evolution of various socioeconomic activities and by estimating the probable technological improvements and lifestyle changes in the coming decades. Basic assumptions concerning population growth and economic development (measured in terms of GDP growth) are analyzed for two sets of assumptions implying relatively high and relatively low economic growth rates. They cover a plausible range of values for world economic growth during the next 50 years. This assessment involved estimating the base year (1975) values of some 180 parameters for each region as projected to the years 2000 and 2030, while incorporating feasible technological improvements and plausible lifestyle changes. It also describes the underlying reasoning and gives sources of information. Energy requirements for sectoral activities and the extent to which conservation is incorporated in the projections are discussed. (PSB)

57095 **United States energy supply and demand forecasts 1979-1995.** Walton, H.L. (DOE, Washington, DC). *Alternative Energy Sources;* 9: 3765-3777(1979). (CONF-791204—).

From 2. Miami international conference on alternative energy sources; Miami Beach, FL, USA (10 Dec 1979).

Forecasts of U.S. energy supply and demand by fuel type and economic sector, as well as historical background information, are presented. Discussion and results pertaining to the development of current and projected marginal energy costs, and their comparison with market prices, are also presented.

57096 **(PB—82-158452) Wisconsin-IIASA set of energy/environment (WISE) models for regional planning and management: an overview.** Foell, W.K.; Buehring, J.S.; Buehring, W.A.; Dennis, R.L.; Hanson, M.E. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 150p. (PR—81-17). NTIS PCE05/MF E05.

The primary objectives of the program were (1) to describe and analyze patterns of regional energy use and to examine the relationship between energy use and socioeconomic and technical variables; (2) to compare and appraise alternative methodologies for regional energy and environmental forecasting, planning, and policy design; (3) to extend and develop concepts and methods for energy/environment management and policy design; and (4) to examine energy strategies for specific regions.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 56153, 56413, 56974, 57055, 57056, 57057, 57076, 57078, 57080, 57089, 57139, 57213

57097 **(AD-A—111546/8) Electric power: contemporary issues and the federal role in oversight and regulation.** (Vermont Univ., Burlington (USA). Dept. of Physics). 21 Dec 1981. 75p. NTIS, PC A04/MF A01.

Electric power will play an important role in the Nation's energy picture, but rapidly increasing fuel prices, lower growth rates, and difficulties in developing large powerplants have made it difficult for electric utilities to provide adequate supplies of power at prices the public is willing to pay. This report provides the Congress with a discussion of: important issues in electric power regulation and management, recent GAO reports on some of those issues, and questions and observations about power system planning and development which deserve Federal attention. It specifically highlights important electric power issues which transcend State, regional, and utility decisionmaking and identifies for the Congress significant areas which should be considered when making decisions affecting the electric power industry.

57098 **(DOE/ES—0002) Energy history chronology from World War II to the present.** Dean, P.C. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Executive Secretary). Aug 1982. 106p. NTIS, PC A06/MF A01. Order Number DE82019872.

This report provides a basic guide to the major Presidential, Legislative, Judicial, and Federal agency actions relating to energy policy, research, development, and regulation in recent years. The chronology is arranged synoptically, allowing users to reference easily the historical context in which each event occurred. Summaries of Presidential, Legislative, and Judicial actions relating to energy, rosters of federal energy officials, and a genealogy of federal energy agencies are also provided in separate appendices. The Energy History Chronology was prepared in conjunction with the History Division's series of pamphlets on the Institutional Origins of the Department of Energy. The series includes concise histories of the Department of Energy, the Energy Research and Development Administration, the Federal Energy Administration, and the Atomic Energy Commission. All significant events and achievements noted in the institutional history are also listed.

57099 **(ILLDOE—82/04) Illinois energy plan. Volume I. An overview of trends in the Illinois electric utility industry.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Jul 1982. 55p. Illinois Dept. of Energy and Natural Resources, 325 W. Adams Street, Springfield, IL 62706.

Portions of document are illegible.

Trends affecting the electric utility industry in Illinois are reviewed in view of the following historical and projected conditions: uncertainty in future demand and consumption of electric power; difficulties associated with capacity expansion; utility costs; and the financial condition of utilities. (PSB)

57100 **(ORNL—5879) Community-based assessment and planning of energy futures. Final report of the decentralized solar-energy technology-assessment program.** Carnes, S.A.; Schweitzer, M.; Bronfman, B.H. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 186p. NTIS, PC A09/MF A01. Order Number DE82020459.

Specific recommendations are given for attracting and retaining competent citizen participation in the local government assessment of technology. The role of information in decentralized energy planning and development is discussed. Positive results are listed as: increased local government and citizen interest; the high quality of policy options identified in plans; the comprehensiveness of the issues addressed; and the wealth of ideas generated for use in other communities. (PSB)

57101 **(USGS-OFR—81-1250) Permit requirements for development of energy and other selected natural resources for the State of Arizona.** (Camp Dresser and McKee, Inc., Wheat Ridge, CO (USA)). Aug 1981. 107p. US Geological Survey, Open-File Services Section, Denver Federal Center, Box 25425, Denver, CO 80225.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57102 **(USGS-OFR—81-1251) Permit requirements for development of energy and other selected natural resources for the State of Arkansas.** Forrest, A.S. (Radian Corp., Austin, TX (USA)). Jul 1981. 81p. US Geological Survey, Open-File Services Section, Denver Federal Center, Box 25425, Denver, CO 80225.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57103 **(USGS-OFR—81-1252) Permit requirements for development of energy and other selected natural resources for the State of California.** (Camp Dresser and McKee, Inc., Wheat Ridge, CO (USA)). Aug 1981. 136p. US Geological Survey, Open-File Services Section, Denver Federal Center, Box 25425, Denver, CO 80225.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57104 **(USGS-OFR—81-1253) Permit requirements for development of energy and other selected natural resources for the State of Colorado.** (Camp Dresser and McKee, Inc., Wheat Ridge, CO (USA)). Aug 1981. 160p. US Geological Survey, Open-File Services Section, Denver Federal Center, Box 25425, Denver, CO 80225.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57105 **(USGS-OFR—81-1265) Permit requirements for development of energy and other selected natural resources for the State of Missouri.** Personett, M.L. (Radian Corp., Austin, TX (USA)). Jul 1981. 69p. US Geological Survey, Open-File Services Section, Denver Federal Center, Box 25425, Denver, CO 80225.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57106 **(USGS-OFR—81-1271) Permit requirements for development of energy and other selected natural resources for the State of Nevada.** (Camp Dresser and McKee, Inc., Wheat Ridge, CO (USA)). Aug 1981. 68p. US Geological Survey, Open-File Services Section, Denver Federal Center, Box 25425, Denver, CO 80225.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57107 **(USGS-OFR—81-1272) Permit requirements for development of energy and other selected natural resources for the State of North Carolina.** (Terry (Claude) and Associates, Inc., Atlanta, GA (USA)). Aug 1981. 89p. Geological Survey, Open-File Services Section, Box 25425, Denver Federal Center, Denver, CO 80225.

Portions of document are illegible.

This guidebook summarizes environmental and land-use permits issued by the State for the development of energy and other natural resources. The guidebook is intended not only for private developers and interest groups, but also for regulatory officials of Federal, State, and local government as well. The guidebook is divided into seven sections: Introductory Information; Consolidated Permit Programs; Local Regulatory Policies; Resource Extraction; Land Use Regulation; Environmental Quality Management; and Social/Ecological Preservation. Each section is divided into chapters; each chapter summarizes one permit, license, or approval. Permits administered by a single agency are generally grouped together in each section. (PSB)

57108 **Energy policy in a changing social order.** Schaller, D.A. (Solar Energy Research Inst., Golden, CO). *Alternative Energy Sources;* **9**: 4007-4020(1981). (CONF-791204—).

From 2. Miami international conference on alternative energy sources; Miami Beach, FL, USA (10 Dec 1979).

In this paper, the background of energy management and use relative to public policymaking is reviewed. Many of the more-prominent social cross currents, such as: consumerism, resistance to nuclear power, tax rebellion, etc., are identified and described. Conventional and alternate energy policy options are analyzed. 41 refs.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 56052, 56061, 56066, 56107, 56109, 56111, 56115, 56161, 56176, 56181, 56211, 56221, 57093, 57128

57109 **(DOE/EP—0036) Report to the President and the Congress on the size of the Strategic Petroleum Reserve.** (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). May 1982. 21p. NTIS, PC A02/MF A01. Order Number DE82014885.

Portions of document are illegible.

This report is to satisfy the requirement of the Omnibus Budget Reconciliation Act of 1981 that the Secretary of Energy transmit a report to the President and the Congress regarding the final storage level of the Strategic Petroleum Reserve (SPR). The legislation requires an analysis of the costs and benefits associated with achieving the 1 billion barrel SPR size set forth in the SPR Plan as amended, and any larger or smaller final storage level which may be appropriate. To be responsive to the specific information request of Congress, the focus of this report is on the quantification of the relative costs and benefits associated with different SPR sizes. In addition, it is recognized that there are other reasons for having a government oil stockpile which are not readily quantified. These reasons include foreign policy and national security implications of a petroleum supply disruption. The Department believes that large strategic oil stockpiles can be cost-effective for coping with oil supply disruptions and recommends continued development of a 750 million barrel (MMB) SPR as provided for in the President's FY 1983 budget proposals. The Department does not believe it is necessary or appropriate to change the SPR Plan provisions for an ultimate stockpile size up to 1 billion barrels, on the ground that increases beyond the planned 750 MMB SPR system at a future date could provide net economic benefits to the United States.

57110 **(DOE/ER/10206—1) Coal and biomass: the role of synfuels. Conference and workshop summaries.** (Midwest Universities Energy Consortium, Chicago, IL (USA)). 1981. Contract FG02-81ER10206. 75p. (CONF-811251—Summ.). NTIS, PC A05/MF A01. Order Number DE82014680.

From Coal and biomass: the role of synfuels conference; Chicago, IL, USA (9 Dec 1981).

Between September and December of 1981 the Midwest Universities Energy Consortium conducted a unique two-part program on the topic of Coal and Biomass: The Role of Synfuels. Program sponsors included the US Department of Agriculture, the US Environmental Protection Agency, the US Department of Energy, the US Department of Transportation and energy agencies in the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio and Wisconsin. Part one consisted of a series of two-day workshops held in selected cities in four Midwest states. Workshops were scheduled on the following topics: Coal, Biomass, Incentives and Land-Use Planning. Participants in these workshops were a blend of university researchers, elected state officials, public interest groups and representatives from energy industries. Together they examined, in detail, the technological and policy issues surrounding their special topic. Following the workshops, a major conference on Coal and Biomass was held at the Palmer House in Chicago, December 9-10, 1981. At this conference, highranking keynote speakers reviewed current technologies and the economic viability of alternative processes for utilizing midwestern coal and biomass, with particular emphasis on synfuel production. In addition, the speakers discussed the future role of DOE and of the Synthetic Fuels Corporation in the development of new technologies. The conference also provided a forum for the highlights of the four workshops on Coal, Biomass, Incentives and Land-Use Planning.

57111 **(PB—82-164062) Rapid growth issues in western oil shale development: uncertainty and impact mitigation. Staff report.** Shillington, T.H. (Economic Research Service, Washington, DC (USA). Economic Development Div.). Dec 1981. 66p. NTIS, PC A04/MF A01.

Uncertainty has characterized western oil shale development and will remain a major factor as commercial projects begin in the early 1980's in Colorado and Utah. Recent estimates of economic impacts, selected for review from State and regional assessments and from USDA/EDD COALTOWN simulations, vary because of data limitations, differences in methodologies, and oil shale development assumptions. Despite the variation in estimates, it seems certain that large local economic impacts will arise with oil shale commercialization. Problems include rapid population inflows, geographic distribution of the new population, timing of project revenues to meet increased demands for local services, and planning uncertainties.

57112 **British and American tax treatment of UK North Sea oil fields.** Moose, J.S. (Standard Oil Co. of Ohio, Cleveland). *Energy Journal;* **3**: No. 2, 55-63(Apr 1982).

The United Kingdom's new oil-field tax system is designed to discourage the development of small as well as marginal fields. Future development of smaller fields, which contain a substantial part of the undiscovered North Sea reserves, will depend on crude prices rising faster or a modification of the tax system to reduce the tax and royalty burden. As a result of differing US and UK depreciation schedules, US oil firms may be liable for some US taxes on North Sea oil profits, but the short period of tax liability is unlikely to be a major disincentive. It would be a disincentive to US developers if UK income taxes were made deductions rather than credits for US tax purposes. The extent of the disincentive would depend on whether a company operates through a US or a foreign subsidiary and on whether the company views the deferral of US income taxes as permanent. 3 figures.

57113 **Report of the Association of Mining Engineers and Technicians on actual state and development trends in mining in Poland.** *Przeglad Gorniczy;* **37**: No. 4, 159-164(Apr 1981). (In Polish).

This paper presents a critical evaluation of the energy policy in Poland in the last decades. Energy consumption of the Polish economy is excessive and cannot be covered as the increase of black coal supply is insufficient, and import of energy is too costly. Investment in the Polish black coal industry is inadequate. Considering coal losses, the minable reserves of black coal decrease yearly by about 250 Mt. To compensate for this so-called industrial reserve decrease, each year new coal mines with minable coal reserves equal to the national reserve decrease should be constructed. As this is not done, minable industrial coal reserves are steadily decreasing which will create difficulties in the coming years. To stop this trend investment should be increased, more intensive coal exploration is advisable, and proportion of funds for opening and development of new coal reserves should be increased. Due to the shortened work week resulting from the labor agreement of 1980 organizational changes in mine management should be introduced. Recommendations on energy policy changes, and directions in coal mining development are made.

57114 **Tiger in your tank: don't count on it.** Askew, W.S.; McNamara, T.M.; Maxfield, D.P. (ORI Inc., Silver Spring, MD). *Alternative Energy Sources;* 9: 3979-3991(1981). (CONF-791204—).

From 2. Miami international conference on alternative energy sources; Miami Beach, FL, USA (10 Dec 1979).

This paper analyzes alternative-fuels commercialization. Following a synopsis of U.S. energy use, the paper discusses the concept of commercialization, and impacts of supply shortages, and demand inelasticity upon commercialization, and the status of alternative-fuels commercialization to date in the United States. 8 refs.

57115 **Progress hitherto and future trends in energy saving techniques in the iron and steel industry.** Oka, A. *Coke Circ.;* 30: No. 3, 162-169(1981). (In Japanese).

This paper outlines the energy saving policies and measures of the Japanese iron and steel industry. Aspects considered include the use of alternative fuels and different operational procedures. (5 refs.)

57116 **Coal conversion and the department of energy.** Workman, J. (US DOE, Washington, DC). *Minutes of the Meeting - Pennsylvania Electric Association, Engineering Section;* 14p, Appendix A(1980). (CONF-8009153—).

From Meeting of the Pennsylvania Electric Association; Philadelphia, PA, USA (18 Sep 1980).

The paper gives an overview of existing legislation (the Fuel Use Act) with utility power plants as opposed to industrial facilities. The Fuel Use Act grants the DOE discretionary authority to prohibit the continued use of oil and natural gas in plants when coal or alternate fuels can be used.

57117 **Environmental aspects of the developing synthetic fuels industry in Kentucky.** Enoch, H.G.; Jones, J.E. Jr. (DOE, Lexington, Ky). pp 153-165 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

The Kentucky Department of Energy has been involved in the siting of coal conversion facilities. The consideration of the environmental aspects of facility siting along with the technical and economic aspects will benefit both the industry and the citizens of Kentucky. This paper identifies and quantifies the impacts of the various conversion technologies on coal, water, and land resources and on the environment. It also examines the cumulative or regional impacts resulting from the location of a number of these commercial-scale conversion facilities in the state. 4 refs.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 57110, 57114

2960 Electric Power

REFER ALSO TO CITATION(S) 56469, 56606, 56639, 56649, 56707, 56708, 56715, 56725, 57076, 57093, 57097, 57114, 57128, 57130, 57134, 57135, 57137, 57204, 57268, 57269

57118 **(EPRI-EA—2491) Marginal-cost pricing under uncertainty. Final report.** Maddala, G.S.; Fishe, R.P.H. (Growth Systems Management, Inc., Gainesville, FL (USA)). Jul 1982. 69p. NTIS, PC A04/MF A01. Order Number DE82905846.

The purpose of this study is to explain what marginal-cost pricing of electricity involves, how the rules change with the incorporation of demand and cost uncertainty and to illustrate these principles with an example. It is pointed out that marginal-cost-based rates and optimal investment plans have to be determined jointly. Thus, there are two rules to be followed: an optimal pricing rule and an optimal investment rule. The former sends proper signals to consumers and the latter sends proper signals to producers. The pricing rule says: Set price = short-run marginal cost if demand is less than capacity output, if demand is higher than capacity output, set the price at a level higher than marginal operating cost so that demand equals capacity output. Thus, contrary to popular belief, price is not always equal to marginal operating cost but it is marginal operating cost on the basis of which price is set. Further we need knowledge of demand elasticities to set prices. Finally, the pricing rule should be used in conjunction with an investment rule which says: Build new capacity when operating costs + marginal rationing costs are greater than marginal capacity costs. These pricing and investment rules have to be changed suitably in the case of demand and cost uncertainty. The report illustrates these principles both with and without uncertainty and points out what data are needed to implement marginal cost pricing. It is also pointed out that some current regulations requiring utilities to report their marginal-costs ask only partial information and are not of much use. Without estimates of demand functions and the optimal investment plans, the marginal costs reported are useless for pricing purposes.

57119 **(EPRI-EL—2455-Vol.1) EPRI generating-unit commitment and production-costing program. Volume 1. User's guide. Interim report.** Seymore, E. (Boeing Computer Services Co., Tukwila, WA (USA). Energy Technology Applications Div.). Jun 1982. 38p. NTIS, PC A03/MF A01. Order Number DE82905809.

Portions of document are illegible.

This document is one of a set of two volumes describing a generating unit commitment program and production costing. The program was developed for use in EPRI research projects and for application to utilities planning and operations problems. The first volume is a user's guide and the second is a programmer's guide.

57120 **(EPRI-EL—2455-Vol.2) EPRI generating-unit commitment and production-costing program. Volume 2. Programmer's guide. Interim report.** Seymore, E. (Boeing Computer Services Co., Tukwila, WA (USA). Energy Technology Applications Div.). Jun 1982. 65p. NTIS, PC A04/MF A01. Order Number DE82906439.

This document is one of a set of two volumes describing a generating unit commitment program and production costing. The program was developed for use in EPRI research projects and for application to utilities' planning and operations problems. The first volume is a user's guide and the second is a programmer's guide.

57121 **(EPRI-P—2410-SR) TAG: Technical Assessment Guide. Special report.** Applegren, G.H.; Vejtasa, S.A. (Electric Power Research Inst., Palo Alto, CA (USA). Technology Evaluation Group). May 1982. 339p. NTIS, PC A15/MF A01. Order Number DE82906430.

This Technical Assessment Guide, (TAG) prepared by EPRI personnel, has been compiled for the use of EPRI staff and its contractors to provide a common basis for evaluation of electric energy R & D alternatives. The guide contains two sections: Guidelines for EPRI R & D evaluation which contains a brief summary of the economic methodology and data on fuel price projections and cost and performance information of transmission and generation technologies; and background for EPRI R & D evaluation which presents a more complete explanation of the economic methodology and a series of sample problems. The economic methodology described in the TAG is the revenue requirement technique, the method generally used by utilities in the economic evaluation of alternatives.

57122 **(EURDS—85) Electric Utility Rate Design Study: costing for ratemaking. Topic Paper 2. Rate design study.** Malko, J.R.; Smith, D.; Uhler, R.G. (Wisconsin Public Service Commission, Madison (USA); Temple, Barker and Sloane, Inc., Lexington, MA (USA); National Economic Research Associates, Inc., Los Angeles, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Aug 1981. 242p. NTIS, PC A11/MF A01. Order Number DE82906434.

The Rate Design Study research has determined that time-of-use (TOU) rates which achieve pricing objectives can be developed using a variety of costing methods and ratemaking approaches. Alternative accounting cost and marginal cost methods have been developed for designing time-of-use rates. To select among these alternative costing and ratemaking approaches, regulators and rate managers must consider their pricing objectives, such as conservation and fairness. The weight given to each objective may vary by utility system, state, or region depending on local circumstances such as dependence on oil for generation, weather, etc. In addition, the Study has contributed to the understanding of the identification of costing periods and the selection of rating periods. Moreover, the Study has explored the design of alternative block rate forms, e.g., flat rates versus inverted rates. Finally, the Study has demonstrated important relationships between costing and ratemaking issues and broader load management concerns, e.g., the questions of using marginal costs to attain economic efficiency and using accounting costs to determine the revenue requirement from each customer class.

57123 **(EURDS—93A) Electric Utility Rate Design Study: costs and rates workbook. Part I. Textbook.** Chamberlin, J. (ICF, Inc., Washington, DC (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Sep 1981. 267p. NTIS, PC A12/MF A01. Order Number DE82905848.

As part of the transfer activities of the Electric Utility Rate Design Study, a set of regional workshops were held in April of 1980 to give utility and commission staff members a chance to apply the marginal and accounting costing methods and to calculate TOD rates based on the various procedures. The objective of the workshops was to emphasize the steps involved in the costing and ratemaking process and to point out what difference it makes if one procedure is used over another at any particular step. To assist in this exercise, a workbook was prepared for the workshop participants. The workbook has been printed as a two-volume publication; this report is one of those volumes. The workbook has three objectives: teach the mechanics involved in the application of various costing for ratemaking methods; provide an understanding of the issues and assumptions involved in applying a specific method; and provide a decision framework for selecting between methods and provide information for determining which methods are most appropriate under specific circumstances. Individual sections of this volume are devoted to: carrying charges; annual marginal demand-related costs; costing and rating periods; allocating costs to time periods; allocating costs to customer classes; energy-related costs; customer costs; and ratemaking procedures and issues. (LCL)

57124 **(EURDS—93B) Electric Utility Rate Design Study: costs and rates workbook. Part II. Learner's guide. Part III. Case studies.** Chamberlin, J. (ICF, Inc., Washington, DC (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Sep 1981. 267p. NTIS, PC A12/MF A01. Order Number DE82906438.

As part of the transfer activities of the Electric Utility Rate Design Study, a set of regional workshops were held in April of 1980 to give utility and commission staff members a chance to apply the marginal and accounting costing methods and to calculate TOD rates based on the various procedures. The objective of the workshops was to emphasize the steps involved in the costing and ratemaking process and to point out what difference it makes if one procedure is used over another at any particular step. To assist in this exercise, a workbook was prepared for the workshop participants. The workbook has been printed as a two-volume publication; this report is one of those volumes. The workbook has three objectives: teach the mechanics involved in the application of various costing for ratemaking methods; provide an understanding of the issues and assumptions involved in applying a specific method; and provide a decision framework for selecting between methods and provide information for determining which methods are most appropriate under specific circumstances. Individual sections of this volume, the learner's guide, are devoted to: selection of costing periods; marginal capacity costs and their attribution to time periods; allocation of accounting costs; calculation of marginal energy costs by costing period; time-of-day (TOD) marginal cost rates; and TOD accounting cost rates.

57125 **(MASEC-CF—81-096, pp 50-64) Rate design considerations for solar applications.** Okon, D.W. (Detroit Edison Co., MI). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

The rate structure for the Detroit Edison electric utility is discussed at length followed by questions and answers concerning specific rates and policies. Specifically, the rates considered are: (1) domestic service; (2) rates for space heating and water heating; and (3) for solar customers, a special space heating and water heating rate. Metering for domestic, space heating, and water heating are discussed along with costs of the meters required. Including residential classes, commercial classes, industrial classes, and other miscellaneous classes, a total of 20 different rate schedules are involved. Costs are broken down into production, transmission, distribution, and general. Policies involved coupled with the desire to be fair in rate schedules are discussed. The rate structure and costs to the customer who supplements his heating needs by using solar collectors for space and/or water heating is explained in detail. The factors of peak use and off-peak use are considered also. (MJJ)

57126 **(PB—82-158551) Arizona electric power: our choices.** DeBano, A.; McNerney, G. (League of Women Voters of Phoenix, AZ (USA)). 1981. 122p. NTIS, PC A06/MF A01.

Presentations of three workshops concerned with electric power consumption and use in Arizona are summarized. Addressed were topics such as energy efficient homes and communities; costs of producing electric power; Arizona's regulatory policy; health, safety, and environmental impact of production; and citizen involvement. Arizona's policy issues in electric power are presented, followed by comments of involved citizens. The anticipated benefits that the state would reap from nuclear power are examined in light of safety, environmental, and social risks. The report points out that benefits and costs to the citizens of Arizona from nuclear power generation are not necessarily the same as those borne by the utilities. It is pointed out that alternatives should be considered that are broader than those which the utilities would consider. Scientists are urged to separate their advocacy roles from their scientific roles.

57127 **(PB—82-160151) Rural electrification: linkages and justifications. Program evaluation discussion paper No. 3.** Tendler, J. (Agency for International Development, Washington, DC (USA)). Apr 1979. 84p. NTIS, PC A05/MF A01.

The author notes that rural electrification planners generally tend to seek replication of the successful Philippine rural electrification(RE) project, which strongly favored household consumption. The author concludes that an RE project is not justified on the basis of household consumption alone; most often the poorest members of the community cannot take advantage of the benefits offered by household electricity. They can benefit much more significantly from the increase in employment which accompanies RE use by producers and from the increase in public services resulting from RE's municipal use. A.I.D. should investigate means of encouraging employment generation in RE projects, e.g., by providing credit and technical assistance to small industries. A.I.D. should also identify public services which are electricity-dependent, such as clinics and schools, and link provision of RE projects with extension of these services. The author also recommends the creation of a central A.I.D. office to promote local(rather than international) suppliers for the equipment and labor demands of infrastructure projects and favors an AID-supported central fund to promote local cooperatives and auto-generation projects. A 94-item bibliography (1966-78) is included.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 57163, 57164, 57165, 57173, 57214

57128 **Growth of energy consumption and prices in the USA, FRG, France, and the UK, 1950 to 1980.** Doblin, C.P. Laxenburg, Austria; International Institute for Applied Systems Analysis (1982). 149p. (IIASA-RR—82-18). International Inst. for Applied Systems Analysis, A-2361, Laxenburg, Austria.

This paper examines data on gross domestic product (GDP), industrial output, energy consumption, and the prices of fuels and electricity in four developed countries (the USA, the Federal Republic of Germany, France, and the United Kingdom for the period of 1950 through 1980. The prices are taken in current values and adjusted for general inflation; they are monitored by broad sectors of the economy (industry, households, and transportation), and for electricity and groups of fuel commodities. The results are presented in four parts: a discussion of the major observations; the data presented in tabular form; a set of graphs showing the growth of energy consumption and prices; and a listing of the concepts, definitions, and sources of the variables selected for study.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 56471, 56474, 56477, 56478, 56507, 56513, 56514, 56526, 56527, 56557, 56558, 56565, 56584, 56586, 56593, 56595, 56596, 56598, 56599, 56605, 56624, 56632, 56636, 56637, 56638, 56639, 56640, 56641, 56643, 56649, 56652, 56666, 56668, 56672, 56680, 56682, 57110, 57185, 57268, 57269

57129 (DOE/EA—0164) **U.S. Ethanol Corporation: loan-guarantee application.** (Department of Energy, Washington, DC (USA)). Apr 1982. 78p. NTIS, PC A05/MF A01. Order Number DE82015936.

Portions of document are illegible.

The scope of this environmental assessment is project- and site-specific. Section 2 describes the project proposed for loan guarantee and the alternatives considered by the applicant. In addition, the alternative of not awarding the loan guarantee (no action alternative) is considered. Section 3 describes the environmental setting of the proposed project, and Section 4 provides an assessment of the impact of the proposed project on the affected environment.

57130 (MASEC-CF—81-096) **Utility planning. Impact of alternate energies: consumer's side of the meter.** (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). 1981. Contract AC02-79CS30150. 406p. (CONF-8104154—). NTIS, PC A18/MF A01. Order Number DE82013427.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Portions of document are illegible.

Separate abstracts were prepared for 17 papers in this conference proceedings. (LEW)

57131 (MASEC-CF—81-096, pp 36-49) **Planning process to evaluate residential solar applications.** Taylor, E.F. Jr. (Northeast Utilities Service Co., Hartford, CT). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

The area serviced by Northeast Utilities (NU) in Connecticut and Massachusetts is reviewed as well as forecasts of electric loads. Growth rate in use of electricity is seen to fall from 7 to 8% to 1 to 2% annually in the past decade. NU's interest in solar energy is traced from its beginning (1973) to the present time and has evolved into a Conservation Program for the 80s/90s. A highly visible effort is being made to stimulate public acceptance of solar assisted heating systems (domestic hot water and space heating). Studies of projected use of solar energy are described and year-by-year studies are reviewed briefly. The effects of wood stoves, coal stoves, and super-insulated homes are also considered. Programs to assist customers concerning solar installation and the effects of tax credits are discussed. (MJJ)

57132 (MASEC-CF—81-096, pp 221-227) **How to conduct a survey on consumers' attitudes on solar energy.** Stolz, D.E. (Public Service Company of New Mexico, Albuquerque). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Work regarding public opinion on energy conservation and solar energy, in particular, is described. Several studies were carried out. The involvement of Public Service of New Mexico in solar programs is reviewed (free solar consultation, computer studies, passive solar and retrofitting advice, etc.). Qualitative (focus groups, in-depth interviews) and quantitative (statistical analyses) studies, routinely carried out, are described. The program to obtain public opinion concerning energy in general and solar energy in particular is described as a market segmentation study involving complex statistics. Homogeneous sub-sets were specified and of 2000 questionaires, 1212 were returned. For segmentation analysis 47 variable and 47 energy questions were asked. Conclusions (energy crisis is real; USA can solve the problem; nuclear power plants will help; solar energy is practical) are summarized. Surprisingly, it was learned that solar energy is not an urgent topic for most people. Few had plans to use solar energy. It is concluded that solar energy must be sold - like any other product - even in a state like New Mexico. (MJJ)

57133 (MASEC-CF—81-096, pp 228-237) **Consumer attitudes on residential solar applications in North Central United States.** Fulenwider, C.K. (Wisconsin Center for Public Policy, Madison). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Results of a study, carried out in Wisconsin, are reported on people's attitudes on solar use (and conservation and alternative energy sources). Barriers and incentives towards solar energy uses, market barriers among consumers, attitudes, reactions, and assessments were all considered. Of particular emphasis was a survey carried out on the 1700 people using solar energy in Wisconsin. Information sought was: (1) relationships between solar energy use and energy attitudes; (2) description of the solar energy users; and (3) the decision factors which led to the choice of solar energy use. A number of findings are reported. These are: (1) 25% of the population believes that renewable energy sources are preferred; (2) 50% of those using renewable sources believe the same thing; (3) conservation is good, but mostly for the other guy; (4) there is high interest but little knowledge about solar energy; (5) solar energy users are, in general, in a higher income group, better educated, willing to take a chance, do-it-yourselfers, environmentalists, willing to be different, and say they went solar for economic reasons. (MJJ)

57134 (MASEC-CF—81-096, pp 246-282) **Planning for solar energy at Southern California Edison.** Stolpe, J. (Southern California Edison, Rosemead). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Present and future resources for power generation at Southern California Edison (SCE) are reviewed. Large dependence on imported oil has led to interest in renewable energy sources including solar energy. The solar and renewable energy program at SCE is described in some detail and includes the following sub-programs: (1) building applications; (2) resource assessment; and (3) power generation (estimated at 40% of new power generation capacity during this decade). Specific programs described and illustrated are: (1) solar space heating applications; (2) solar cooling (peak demand is in afternoons in summer); (3) solar water heating; (4) insolation measurements; (5) wind resource assessment and windmills; (6) solar thermal power generation; (7) photovoltaics; (8) salt ponds; and (9) power from biomass. It is concluded that practical and profitable solar installations must be regionally specific depending on the resources available. Also, the utility business must continue to change and evolve. (MJJ)

57135 (MASEC-CF—81-096, pp 283-292) **Accomplishments of the solar program: implementation of the customer's use of electrical energy systems.** Martin, R.S. (Dept. of Energy, Washington, DC). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

The use of renewable energy in the USA is reviewd briefly and it is pointed out that about 5% of the nation's energy today is from renewable sources (including hydroelectric). The forest products industry provides almost 2 quads by direct combustion processes. The philosophy of the Department of Energy (DOE) is discussed, particularly in the light of the new administration, demphasis of government control, and allowing the market place to set the pace. It is pointed out that (in the Federal Government) re-evaluation is taking place; priorities are being changed; overall uncertainties exist concerning planning for future energy sources; and many alternatives are under consideration. It is pointed out that each utility is different and each has its own resources, problems, options and prices (wide variation in the price of electricity over the country exists). The status of renewable energy technology is reviewed briefly in the areas of solar heating and cooling, photovoltaics, biomass, solar thermal, wind energy, ocean thermal conversion, geothermal, small scale hydroelectric, and urban waste. It is concluded that there is a very positive future for all the above energy supply options. (MJJ)

57136 (PB—82-160284) **On steady states in stochastic systems: stochastic models of management of renewable resources.** Flam, S.D. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). 6 May 1980. 11p. (CMI—802510-3). NTIS, PC A02/MF A01.

A stochastic system is in a steady state when the outcome is produced according to a stationary probability distribution. The existence of such a probabilistic equilibrium is proved under certain conditions. The model presented can be applied to the management of renewable resources.

57137 **Financing solar repowering and the quantification of external benefits.** Kamin, J.H.; Ellis, J.C. (Aerospace Corp., El Segundo, CA). *Energy Journal;* **3**: No. 2, 167-184(Apr 1982).

A simulation model for quantifying utility energy costs is applied to determine cost and performance data for the proposed Saguaro power plant repowering project of the Arizona Public Service Company. The capitalized economic resource cost of this project is also computed with a national cost-benefit analysis. One application uses a projection of the world price of crude oil to obtain the average cost of displaced fuel. A second application derives the marginal cost of displaced fuel from a monopsony model of US petroleum supply. The evaluation approach is equally applicable to any imported-petroleum-displacing energy project, such as the use of methanol to fire turbines or boilers in peak- or intermediate-load generators, with the methanol derived from domestic coal, biomass, or foreign natural gas imported as methanol. 18 references, 2 figures.

57138 **Toward a renewable-energy future: the urban potential - Austin, Texas.** Austin, TX; University of Texas (1982). 131p. (NP—2904447). Univ. of Texas, Lyndon B. Johnson School of Public Affairs, Austin.

The kind and quality of Austin, Texas' energy sources and its pattern of energy consumption are analyzed, followed by an analysis of conservation and solar energy in residential and commercial structures, justifications for instituting a solar energy code, and the prospect of small business opportunities in solar energy. The possibility of converting municipal solid wastes to energy and the role of the city's electric department in promoting the use of renewable resources are examined. The outline is provided of an information/skills transfer program that can be used to increase public awareness, receptivity, and confidence in renewable energy alternatives. (LEW)

57139 **National goals for solar energy.** Pesacreta, P.J.; Bezdek, R.H. (US DOE, Washington, DC). *Alternative Energy Sources;* **3**: 1321-1331(1981). (CONF-791204—).

From 2. Miami international conference on alternative energy sources; Miami Beach, FL, USA (10 Dec 1979).

The U.S. Federal Government has increased its commitment to solar energy and has set very ambitious goals for its commercialization. This paper traces the developments leading to these goals, the impacts of achieving these goals, and discusses methods for accelerating solar commercialization. 10 refs.

30 DIRECT ENERGY CONVERSION

57140 **Proceedings of the intersociety energy conversion engineering conference, 16th: technologies for the transition, 1981. 3 volumes.** New York, NY; American Society of Mechanical Engineers (1981). 2608p. (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This conference is published in three volumes and contains 405 papers, 401 of which were abstracted separately. The subject matter is concerned with various forms of energy conversion, the components used, and the impact on the economic and sociological status of these technologies. Residential, power plant and military applications are discussed.

3001 Mhd Generators

REFER ALSO TO CITATION(S) 56875, 57753, 58397, 58398

57141 (DOE/NASA/10769—26) **Comparative analysis of the Conceptual-design Studies of Potential Early Commercial MHD power plants (CSPEC).** Sovie, R.J.; Winter, J.M.; Juhasz, A.J.; Berg, R.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Gilbert Associates, Inc., Gaithersburg, MD (USA)). 1982. Contract AI01-77ET10769. 25p. (NASA-TM—82897; CONF-820645—3). NTIS, PC A02/MF A01. Order Number DE82017569.

From 12. symposium on engineering aspects of magnetohydrodynamics; Los Angeles, CA, USA (14 Jun 1982).

Tasks II and III of the Parametric Study of Potential Early Commercial MHD Plants (PSPEC) have essentially been completed. Task II (CSPEC) consisted of a conceptual design study of the MHD/steam plant that incorporated the use of oxygen enriched air preheated in a metallic heat exchanger as the combustor oxidant. This plant was found the most attractive for early commercial applications in Task I. In Task III the variation of performance and cost was investigated as a function of plant size. The efforts were performed by contractor teams led by Avco and General Electric Company. The Avco effort has been completed. The GE team has completed the plant design and performance studies but is presently reassessing the cost estimates for these plants. The contractors' results for the overall efficiencies are in reasonable agreement considering the slight differences in their plant designs. The Avco results varied from ~ 44 to 41% and GE's from ~ 43 to 39% as the plant size varied from ~ 1000 MW/sub e/ to 200 MW/sub e/. Both contractors predicted reasonable performance (~ 42%) at a part load operating condition of 75% of full load. The Avco cost results were reasonably consistent with those presented in PSPEC and compare favorably with those for conventional coal-fired steam plants over the range of plant sizes from 200 to 950 MW/sub e/.

57142 (NASA-TM—82750) **Effect of vacuum exhaust pressure on the performance of MHD ducts at high B-field.** Smith, J.M.; Morgan, J.L.; Wang, S.Y. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1982. 13p. NTIS, PC A02/MF A01.

The effect of area ratio variation on the performance of a supersonic Hall MHD duct is investigated. Results indicate that for a given combustion pressure there exists an area ratio below which the power generating region of the duct is shock free and the power output increases linearly with the square of the magnetic field. For area ratios greater than this, a shock forms in the power generating region which moves upstream with increasing magnetic field strength resulting in a less rapid rise in the power output. The shock can be moved downstream by either increasing the combustion pressure or decreasing the exhaust pressure. The influence of these effects upon duct performance is presented.

57143 **(PB—82-176926) The Montana Energy and MHD Research and Development Institute, Inc. Final report.** (Montana Energy and MHD Research and Development Inst., Inc., Butte (USA)). Oct 1981. 124p. NTIS, PC A06/MF A01.

The business of commercializing a new product, service, or technique requires a broad variety of disciplines and experience. In most instances, inventors are not equipped to provide, either from their own capabilities or through paying for others, the necessities. The services of legitimate organizations, such as the Center for Innovation, are very badly needed in today's world, and although several have been developed in the past few years, the demand for good assistance has not been diminished. The Center's operation has dealt primarily with independent inventors versus those associated with large or even small corporations.

57144 **Method for manufacturing magnetohydrodynamic electrodes.** Killpatrick, D.H.; Thresh, H.R. (to Department Of Energy). US Patent 4,330,920. 25 May 1982. Filed date 24 Jun 1980. vp.

PAT-APPL-162543.

A method of manufacturing electrodes for use in a magnetohydrodynamic (MhD) generator comprising the steps of preparing a billet having a core of a first metal, a tubular sleeve of a second metal, and an outer sheath of an extrusile metal; evacuating the space between the parts of the assembled billet; extruding the billet; and removing the outer jacket. The extruded bar may be made into electrodes by cutting and bending to the shape required for an mdh channel frame. The method forms a bond between the first metal of the core and the second metal of the sleeve strong enough to withstand a hot and corrosive environment.

57145 **Analysis of power takeoff in diagonal conducting wall channels.** Kuo, S.; Levi, E. (Polytechnic Inst. of New York, Farmingdale). *Journal of Energy;* **6**: No. 2, 96-103(Mar 1982). Contract AC01-78ET11056.

An analysis of diagonal-conducting-wall MHD channels leads to design principles for the power takeoff and good quantitative agreement with experimental data. The effect of power takeoff schemes on the output power level is investigated analytically. It is found that it is possible to design the electrical circuit of the channel with passive elements in the takeoff region, and, achieve a fairly even load current distribution under changing load conditions without loss of power output.

57146 **Wall leakage effect on nonuniformities in diagonal MHD channels.** Kuo, S.; Levi, E.; Cheo, B. (Polytech Inst of NY, Farmingdale). *Journal of Energy;* **5**: No. 3, 158-163(May-Jun 1981).

The effect of wall leakage, symmetric as well as asymmetric, is examined in the linear and nonlinear regimes. It is found that: the range of wavelength in the nonuniformities is reduced and in the asymmetric case splits into two separate passbands; depending on the wavelength, forward waves can propagate both upstream and downstream, and backward waves only upstream; the growth rate is minimal when the leakage at the cathode wall is four times that of the anode wall; and in all cases, a resistance introduced in the diagonal bars reduces the growth rate by a constant. 4 refs.

57147 **Rechargeable alkaline zinc/ferricyanide hybrid redox battery.** Adams, G.B.; Hollandsworth, R.P.; Littauer, E.L. (Lockheed Palo Alto Res Lab, Calif, USA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 812-816(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The zinc/ferricyanide battery system is described for utility load leveling and solar photovoltaic/wind applications, with advantages of high cell voltage, near-ambient temperature operation, flowing alkaline electrolyte, low-cost reactant storage, low toxicity, potentially long cycle life and low projected capital costs. 13 refs.

57148 **Heat transfer in slagging MHD radiant boilers.** Im, K.H.; Ahluwalia, R.K.; Berry, G.F. (Argonne Natl Lab, IL USA). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

A combined convection-radiation model is formulated to study heat transfer characteristics of slagging magnetohydrodynamic (MHD) radiant boilers. The model includes the contributions of carbon dioxide, water vapor, potassium atoms, and slag particles to gas radiation. The model also accounts for the presence of slag layer on the wall of the radiant boiler. In order to determine the slag layer dynamics, the mechanism of slag particle deposition by thermophoresis and by fluid turbulence is also investigated. The role of a slag layer in moderating the influence of refractory thickness on heat transfer is illustrated. 14 refs.

57149 **Comparison of analytical and experimental studies of the HPDE MHD generator performance.** El Derini, Z.; Doss, E.D.; Lenzo, C.S. (Argonne Natl Lab, Ill, USA). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

The magnetohydrodynamic (MHD) generator performance of the High Performance Demonstration Experiment (HPDE) has been analyzed using the Argonne National Laboratory quasi-three-dimensional computer model. Computations performed for the operating conditions of tests No. 10 and 14 indicate that the trends and magnitudes of the experimental data for various electrical and gasdynamic variables are in good agreement with the analytical predictions. Variation of channel performance as a function of channel wall temperature, surface roughness, load factor, and magnetic field strength is examined, and numerical examples are given. Performance maps, showing channel enthalpy extraction versus isentropic efficiency, are generated for a range of magnetic field strengths, loading parameters, and electrode surface temperatures. A "diagnostic data analysis" procedure has been developed for further verification of the accuracy of the predictions of the quasi-three-dimensional model.

57150 **Experimental results of the UTSI coal-fired MHD generator and investigations of various power take-off schemes.** Galanga, F.L.; Lineberry, J.L.; Wu, Y.C.L.; Scott, M.H.; Baucum, W.E.; Clemons, R.W. (Univ of Tenn, Tullahoma). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

Tests were conducted at The University of Tennessee Space Institute, Energy Conversion Division, in support of technology development of coal-fired magnetohydrodynamic (MHD) generator systems. The primary objectives of the test series were to evaluate the overall electrical performance of the 60/degree/ DCW generator with vitation heated oxidizer, to study the thermal behavior of capped versus solid frame electrodes, and to investigate various power take-off schemes. Results from the above-mentioned areas of investigation are presented and discussed. 13 refs.

57151 **Three-dimensional flow and heat transfer development in MHD channels.** Vanka, S.P.; Ahluwalia, R.K. (Argonne Natl Lab, Ill, USA). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

The development of the three-dimensional flow and temperature fields in an MHD channel is studied. The partial-differential equations for the three momenta, the enthalpy, and the electrical fields are solved by a finite-difference calculation procedure. The turbulence phenomenon is represented by a two-equation turbulence model, in which additional equations are solved for the kinetic-energy of turbulence and its dissipation rate. Calculations are made for typical MHD channel conditions in the subsonic flow regime. Interesting secondary flow patterns are observed to develop along the duct as the flow and electrical fields interact with each other. The detailed development of the three-dimensional flow, temperature, and electrical fields is presented. 8 refs.

57152 **Three-dimensional analysis of MHD generators: development of electrical solution.** Ahluwalia, R.K.; Vanka, S.P.; Im, K.H. (Argonne Natl Lab, Ill, USA). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

A model for calculating three-dimensional current and electric field distributions in MHD generator channels is formulated and numerically solved. The chief advantage of this model is that its solution can be implemented on the digital computer in less than one CPU second and thus the model can be conveniently coupled to a full three-dimensional gas dynamic analysis. The model is equally valid for Faraday, diagonal insulating-side-wall, and diagonal conducting-sidewall channels. Accuracy of the model is calibrated by comparing its predictions with the results of three-dimensional finite segmentation analyses. The model is found to perform best for channels with low wall temperatures and low electrode pitch-to-height ratios, and when the boundary layers are thick. 14 refs.

57153 **Off-design study of an open-cycle MHD power plant with oxygen enrichment.** Geyer, H.K.; Berry, G.F. (Argonne Natl Lab, Ill, USA). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

This paper explores some of the more important aspects of off-design operation for an magnetohydrodynamic (MHD) power plant. An essential requirement is that the plant be designed to meet part-load and overload conditions. Furthermore, the optimal design should be subject to a specified load demand curve. For off-design regimes, an analysis is made to determine the compatible joint operating conditions for an MHD topping cycle, a steam bottoming plant, a turbine train, a compressor, and an oxygen separation plant. The analysis performed is subject to constraints (e.g. metal temperatures, second law violations, component performance requirements, environmental considerations). 12 refs.

57154 **Effect of secondary combustion on nitric oxide concentrations in a MHD combustion gas.** Dunn, P.F.; Johnson, T.R.; Reed, C.B.; Chasanov, M.G.; Inbody, M.A. (Argonne Natl Lab, Ill, USA). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

Results are presented of recent investigations of the effect of secondary combustion on nitric oxide (NO) concentrations in magnetohydrodynamic (MHD) combustion gas. Forty-one experiments, in which NO concentration measurements were made, were conducted. In sixteen of those experiments, secondary combustion of the MHD combustion gas was achieved over two temperature ranges (1500-1800 K and 1700-2000 K). A model assuming instantaneous mixing, and using an Argonne modification of the NASA chemical kinetics code, predicted to within a 10% for all clean-fuel experiments conducted the measured changes in NO concentrations that resulted from secondary combustion. This model was extended to estimate changes in NO concentrations that would occur during secondary combustion in a larger MHD facility. 23 refs.

57155 **Comparison of experimental results from the UTSI coal-fired MHD generator to theoretical predictions.** Lineberry, J.; Galanga, F.; Liu, B.L.; Wu, Y.C.L.; Scott, M.; Pan, Y.C.; Doss, E.D. (Univ of Tenn, Tullahoma). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

Experimental data collected from recent coal-fired magnetohydrodynamic (MHD) generator tests conducted at the University of Tennessee Space Institute (UTSI) are compared to theoretical predictions. Three independent numerical models are employed: a one-dimensional model, a two-dimensional model which includes modeling of the slag layer, and a quasi three-dimensional model. Comparisons are made between measured gas dynamic and generator electrical performance parameters to those predicted by each method. The analyses illustrate the effects of flow field dimensionality on generator performance predictions. Discussions on the applications and limitations of each code are included along with suggestions for refinements to achieve an improved modeling of real MHD phenomena. 19 refs.

57156 **U-25b MHD generator performance.** Picologlou, B.F.; Doss, E.; Pan, Y.; Petrie, T. (Argonne Natl Lab, IL). *AIAA Paper;* vp(1981). (CONF-810106—).

From 19. Aerospace Sciences meeting; St Louis, MO, USA (12 Jan 1981).

The performance of the U-25B magnetohydrodynamic (MHD) generator is analyzed with theoretical predictive models developed at Argonne National Laboratory. Modifications and improvements of the computer codes, motivated from study of the experimental results, are outlined and discussed. The theoretical predictions are compared to experimental results and good agreement is found. Sensitivity studies involving a number of input parameters are used to identify those parameters that have a strong impact on generator performance.

57157 **New liquid-metal MHD concepts for solar and coal.** Pierson, E.S. (Argonne Natl Lab, IL). *Proceedings of the American Power Conference;* **42**: 379-385(1980).

The two-phase generator, liquid-metal magnetohydrodynamic (LMMHD) energy-conversion concept was initially developed at Argonne National Laboratory to meet the anticipated need for an energy-conversion system compatible with liquid-metal-cooled heat sources, such as the liquid-metal fast breeder reactor (LMFBR) and the controlled thermonuclear reactor (CTR). Further options are described. 7 refs.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 56709

57158 **(DOE/NASA/0241—4) Develop and test fuel-cell-powered on-site integrated total-energy systems: Phase III, full-scale power-plant development. Fourth quarterly report, November 1981-January 1982.** (Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div.). 21 Jun 1982. Contract AI01-80ET17088. 59p. (NASA-CR—167898). NTIS, PC A04/MF A01. Order Number DE82020724.

Portions of document are illegible.

Major conclusions from the on-site system application analysis (Arthur D. Little, Inc.) are summarized. OS/IES internal rates of return (IRR) are relatively attractive when the fuel cell system is designed for the base-load, rather than for the average-load, and when operated on natural gas, rather than on methanol. For this grid-connected system, electric utility rate structures are more important in determining IRR than building loads and climate. High demand for hot water has been identified as an important consideration in matching the energy capabilities of the OS/IES to the site. Building types that will be analyzed extensively are hospitals, offices, apartments, and retail stores. Preparations have been completed for the first test of a full-sized single-cell (0.33 m x 0.56 m). Emphasis of the methanol fuel processor development program has shifted toward the use of commercial shell-and-tube heat exchangers. An improved method for predicting the carbon-monoxide tolerance of anode catalysts is described. This is a cyclic-voltametric test and correlates well with the results of much more time-consuming single-cell testing. Other stack support areas reported on include improved ABA bipolar plate bonding technology, improved electrical measurement techniques for specification-testing of stack components, and anodic corrosion behavior of carbon materials. The conclusion of endurance testing of the thermally stable and ethanol-resistant C70-2RS methanol-reforming catalyst is presented and results are compared to those obtained earlier on T2107RS catalyst.

57159 **(PB—82-181272) Evaluation of natural gas molten carbonate fuel cell power plants. Final report 1 Mar 80-1 May 81.** King, J.M.; Levy, A.H.; Van Dine, L.L.; Wertheim, R.J. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Aug 1981. 157p. (FCR—3522-2). NTIS, PC A08/MF A01.

Three advanced molten carbonate fuel cell power plant concepts designed to provide greater quantities of high quality reject heat show significant advantage over both advanced phosphoric acid systems and conventional molten carbonate systems for industrial cogeneration with natural gas. Cost and energy savings with the best system (internal reforming) are 20 and 15 percent respectively when compared to a conventional utility approach with purchased power. The other advanced systems - anode exhaust recycle through an adiabatic reformer and steam separator - also show significant savings. Technology goals and cell stack sizes are consistent with the objectives of other programs meeting both cost and endurance goals, all of which are important to the success of the industrial cogeneration application. The favorable characteristics of an internal reforming system are based on several technical assumptions which must be resolved. The industries for which the use of natural gas molten carbonate fuel cell power plants would provide greatest benefit are: chlorine, various paper products, alumina, nylon, polyethelyne, and polyvinyl chloride.

57160 **Comparison of materials as oxygen catalytic electrodes on zirconia electrolyte.** Isaacs, H.S.; Olmer, L.J. (Brookhaven Natl Lab, Upton, NY). *Journal of the Electrochemical Society;* **129**: No. 2, 436-443(Feb 1982).

A study has been conducted on the effects of electrode materials on the kinetics of the oxygen reaction at electrodes on zirconia at 1000/degree/C in air. Single point contact electrodes were used to overcome differences in morphologies of porous electrodes. The areas of contacts were calculated from the electrolyte resistance considering the electrode/electrolyte interface as a disk. The dimensions of the disk were used to normalize the currents observed at -100 mV potential as current per unit length of disk perimeter. These specific currents varied by nearly three orders of magnitude for the metals and oxides tested demonstrating the importance of the catalytic nature of the electrode material and its surface. Impedance measurements at zero overpotential showed a much smaller dependence on the electrode materials. 44 refs.

57161 **Fabrication and properties of a porous lithium aluminate electrolyte retainer for molten carbonate fuel cells.** Singh, R.N.; Dusek, J.T.; Sim, J.W. (Argonne Natl Lab, Ill). *American Ceramic Society Bulletin;* **60**: No. 6, 629-635(Jun 1981).

Electrically insulating ceramics, in the form of flat plates with controlled porosities and pore sizes, are required in molten carbonate fuel cells to retain the electrolyte at a temperature of 923 K. A ceramic processing method that included powder preparation, cold-pressing, and sintering was used to fabricate an LiAlO/sub 2/ structure with a controlled microstructure. Techniques for impregnating the porous structures with a molten carbonate electrolyte and the characteristics of the electrolyte-impregnated structure are also described. 9 refs.

57162 **Carbon supports for phosphoric acid fuel cell electrocatalysts: alternative materials and methods of evaluation.** McBreen, J. (Brookhaven National Lab., Upton, NY); Olender, H.; Srinivasan, S.; Kordesch, K.V. *Journal of Applied Electrochemistry;* **11**: 787-796(1981). Contract AC02-76CH00016.

In early development of the phosphoric acid fuel cell, the most common carbon support material for the platinum catalyst was a Cabot Corporation furnace black called Vulcan XC-72R. Even though use of this material facilitates dispersion of platinum and electrode fabrication, it is unstable at elevated temperatures and high electrode potentials. At present the main approach to the problem is to heat-treat the Vulcan material or use acetylene black. The present study is an evaluation of five Cabot Corporation furnace blacks of widely varying physical and chemical properties, including Vulcan XC-72R. These studies include an investigation of wetting characteristics, oxygen reduction on platinum supported on these carbons, and a determination of carbon stability using a cyclic voltammetric technique. Carbons with high volatile content and acid pH (Cabot Corporation Mogul 1300, CSX 98 and Mogul L) were hydrophobic and inhibited platinum dispersion. Platinum dispersion was good on Vulcan XC-72R but the platinum sintering rate was high. One carbon (Regal 660R) with a low volatile content and a neutral pH had high platinum dispersion, good electrode performance, a negligible platinum sintering rate and a high resistance to corrosion. It appears to be a potentially useful substitute for Vulcan XC-72R.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

57163 **(NP—2904367) Illinois energy consumption. Statistical report, 1970-1979.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA). Div. of Policy and Planning). Mar 1982. 61p. NTIS (US Sales Only). Order Number DE82904367.

Portions of document are illegible.

Extensive statistical and graphic information about energy consumption in Illinois by end-use sector and by fuel type is presented. Substantial revisions made by US DOE to the data are identified in appendix A. Historical data (before 1970) are included in Appendix B. (MCW)

57164 **(NP—2903922) Missouri energy profiles 1980.** (Missouri Dept. of Natural Resources, Jefferson City (USA). Div. of Energy). 226. 1981p. NTIS, PC A11/MF A01. Order Number DE82903922.

Portions of document are illegible.

The Missouri Energy Profiles is intended to be a reference source for government decision makers and the energy producers and consumers regarding the sources and uses of energy in Missouri. Historical data on energy production, consumption, resources, prices, and other related daa are provided. These extensive data include petroleum and petroleum products, natural gas, coal, and electric power. Data are given on energy interstate shipments and imports. The Profiles include a glossary.

57165 **(NP—2904123) Illinois energy consumption trends 1960-2000.** (Illinois Inst. of Natural Resources, Springfield (USA)). [nd]. 150p. NTIS, PC A07/MF A01. Order Number DE82904123.

Historical trends in Illinois energy consumption and projected trends through the year 2000 are presented. Findings show that 4215.9 trillion Btu of primary energy (i.e., excluding electricity) were consumed in Illinois in 1978, equal to roughly 5.4% of total US consumption. 1978 consumption represented about a 68% increase over 1960 consumption. Consumption of all primary fuels increased, with natural gas showing the largest growth (126%) and coal the least (1.3%). The energy content of all of the fuels consumed increased with the exception of energy from coal, which declined by 10%. This occurred because of the increasing share of total coal consumption contributed by western coals, which have a lower energy content per ton. Consumption of electricity in Illinois in 1978 totalled 330.7 trillion Btu, equal to about 96.9 billion kilowatt hours. Between 1960 and 1978, consumption increased by 185%, equal to an average annual rate of 5.9%. From 1960 to 1973, electricity consumption rose an average of 7.5% per year. Consumption levels fell during 1974 and 1975, coinciding with the economic recession, and thereafter rose at an average annual rate of 4.5% for 1975 to 1978. Consumption data by sector are presented in detail.

3201 Buildings

REFER ALSO TO CITATION(S) 56459, 56585, 56588, 56593, 56600, 56673, 57021, 57075, 57077, 57125, 57131, 57242, 57259, 57277

57166 **(AD-A—108821/0) Kimborough Hospital energy audit. Final report.** Fell, R.W. (NUS Corp., Rockville, MD (USA)). Sep 1981. 78p. NTIS, PC A05/MF A01.

The results of an energy audit on Kimborough Hospital, Fort Meade, Maryland, are detailed herein. The report investigates various systems which consume energy in order to identify energy conservation opportunities. These selected systems include HVAC equipment, temperature and humidity controls, heat recovery equipment, building insulation, ventilation rate reduction, lighting systems and domestic hot water. The study analyzes energy conservation opportunities to determine which are cost effective and produce adequate energy savings.

57167 (AD-A—109022/4) Energy co914639servation in Navy family housing: a 'master-metered' approach. Technical report Jul-Oct 79. Feher, B.; Little, D.F.; Somer, E.P. (Navy Personnel Research and Development Center, San Diego, CA (USA)). Nov 1981. 39p. (NPRDC-TR—82-18). NTIS, PC A03/MF A01.

The purpose of the study was to develop, implement, and evaluate an intensive behavioral approach for inducing energy conservation in master-metered Navy family housing. A 200-unit housing complex was divided into equal-sized groups and treatment was randomly assigned to one group. Participants received energy-related materials and feedback regarding group energy consumption. An energy coordinator made household visits to participating residences. The participating group significantly reduced their electricity consumption to a level 4 percent below that of the control group. Energy-related attitudes, as measured by a questionnaire, were not found to be significant predictors of consumption. Consumption feedback and personal contact are seen as important supplements to traditional educational approaches to inducing behavioral change.

57168 (AD-A—109655/1) Energy-related attitudes of Navy family housing residents. Report No. 2, Mar-May 1979. Little, D.F.; McCabe, K.I.; Mills, S.; Feher, B.; Somer, E.P. (Navy Personnel Research and Development Center, San Diego, CA (USA)). Dec 1981. 43p. (NPRDC-TR—82-20). NTIS, PC A03/MF A01.

The purpose of the study was to assess the energy-related attitudes, opinions, and practices of Navy family housing residents. Residents of five family housing installations located throughout the United States were surveyed. Emphasis was directed toward the evaluation of energy-related attitudes, housing problems, variables affecting conservation, and energy consumption practices. Residents' attitudes were generally of a proconservation nature, although substantial discrepencies were evident. Residents saw conservation information as most promotive of conservation; and the lack of information about energy costs and consumption and the structural soundness of the housing, as the greatest hindrances to conservation. Most residents reported they performed both one-time and recurring conservation-oriented practices. However, considerable room remains for increasing performance rates of both kinds of practices. Recommendations included implementing an educational program aimed at forming proconservation attitudes and conveying information about energy-efficient practices, utility consumption, and costs. Structural maintenance and modifications should be integrated with educational efforts.

57169 (AD-A—109876/3) Economic analysis of air-conditioning systems with off-peak chilled-water storage. Master's thesis. McMullen, B.J.; Papaprokopiou, N.D. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1981. 240p. (AFIT-LSSR—66-81). NTIS, PC A11/MF A01.

This thesis investigates current methods of chilled-water storage for air conditioning applications and the economics of chilled-water storage with time-of-use electric utility rates. Current methods of chilled-water storage are investigated by comparing costs of construction materials for storage tanks and effectiveness and costs of anti-blending systems. The economics of chilled-water storage are analyzed by computing total life cycle costs of alternative air conditioning systems for two different sized buildings. Computer simulation is used to determine electric consumption for the buildings. The simulation of each building contains three options: no chilled-water storage, chiller operated only at night, and a small chiller supplemented by stored chilled-water. A gunite or Styrofoam tank with a moving partition anti-blending system is the least expensive and most effective storage system. The economics of chilled-water storage are sensitive to the size of the building analyzed. Operating the small chiller with supplemental chilled-water is economical in the smaller building. No chilled-water storage is the most economical option in the larger building. Operation of the chiller only at night was never economical.

57170 (AD-A—109880/5) Development of a multiple linear regression model to forecast facility electrical consumption at an Air Force Base. Master's thesis. Weck, F.H. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1981. 115p. (AFIT-LSSR—68-81). NTIS, PC A06/MF A01.

Various Department of Defense (DOD) and Air Force facility project improvement programs exist to allow existing and new facilities to be more energy efficient to meet the energy reduction goals imposed by the Congress and the President. For the Air Force to effectively satisfy the goals of electrical energy conservation, it is necessary to identify those variables that influence facility electrical energy. The current lack of a satisfactory method to predict electrical usage at Air Force bases is reducing our ability to manage future energy conservation. The author, using the technique of multiple linear regression, examined the role that the variables of heating and cooling degree days, square footage of facilities, and base population take in determining the amount of electricity consumed by fifteen Air Force bases in the Continental United States. Regression analysis revealed that linear models can be developed that are good predictors of facility electrical energy consumed by an Air Force base.

57171 (AD-A—110410/8) Heating, ventilating, air conditioning and dehumidifying systems. Final report. (Naval Facilities Engineering Command, Alexandria, VA (USA)). Aug 1980. 220p. NTIS, PC A10/MF A01.

Basic guidelines for the design of heating, ventilating, air conditioning, and dehumidifying systems for Naval Shore Facilities are presented. The contents include administrative policy, engineering design criteria, calculation procedures, basic system descriptions, system and equipment selection criteria, control system criteria, and energy conservation considerations.

57172 (AD-A—110958/6) Energy management for navy family housing: a manual for voluntary residential energy conservation. Technical report, April 1980-September 1981. Little, D.F.; Feher, B.; Somer, E.P. (Navy Personnel Research and Development Center, San Diego, CA (USA)). Jan 1982. 118p. (NPRDC-TR—82-22). NTIS, PC A06/MF A01.

Declining energy supplies and skyrocketing energy costs have made it essential that the Navy emphasize conservation in all sectors of its activities. This report presents a manual designed to provide housing administrators with a relatively efficient, step-by-step approach to designing and conducting a local energy conservation program over an extended time period. Principles included in the manual were based on results of previous research efforts concerned with energy conservation in the Navy.

57173 (ANL/SPG—18) Optimal sizing of heating systems that store and use thermal energy. Hersh, H.N. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-38. 59p. NTIS, PC A04/MF A01. Order Number DE82003011.

This report presents an analysis of the factors that enter into the sizing of thermal energy storage (TES) space heating systems. These TES systems, having to fulfill the same thermal comfort functions as conventional space heating systems, have different operating characteristics and more severe constraints, and therefore require different and more critical sizing procedures. Thermal energy storage heating systems offer social and private benefits, and the achievement of these benefits depends in large part on proper sizing. Proper sizing is a probabilistic rather than a deterministic procedure, and is utility-specific as well. Analysis of experimental data obtained in field studies of TES in New England has provided information on the accuracy of equipment-sizing procedures used by vendors and on the consequences of undersizing and oversizing. Based on simulation studies and other techniques, additional useful sizing information has been developed. The information implies the need for an upward adjustment of the sizing factor if the sizing is to be optimal for US climatological conditions and living habits. A summary and a general theoretical analysis of the information presented in this report are then combined to provide guidelines for optimally sizing TES systems.

57174 (CONF-820664—9) Field testing energy-saving hermetic compressors in residential refrigerators. Sauber, R.S.; Middleton, M.G. (Oak Ridge National Lab., TN (USA); Kelvinator Compressor Co., Grand Rapids, MI (USA)). 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE82018264.

From ASHRAE national meeting; Toronto, Ontario, Canada (27 Jun 1982).

The design of an energy saving compressor for low back pressure applications is reviewed. Calorimeter performance results are stated for two sizes of the efficient design and compared with performance test results for a standard compressor. Power consumption of a refrigerator-freezer is given with a standard compressor and with the energy saving compressor. The preparation of the refrigerators used in the field test are discussed along with the criteria used in selecting the instrumentation for the project. Results of the energy saving compressor in the field test along with a comparison to a standard production compressor are presented. Some conclusions are drawn, based on the data, in relation to important factors in residential refrigerator power consumption.

57175 (CONF-8011155—) Guidance, control and optimization of heating and air conditioning systems. (Hauptbereatungsstelle fuer Elektrizitaetsanwendung e.V., Hannover (Germany, F.R.). Aussenstelle). 1981. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903646.

From North-German experts' meeting on guidance, control and optimisation of heating and air conditioning systems; Bremen-Vegesack, F.R. Germany (4 Nov 1980).

Separate abstracts were prepared for the papers presented at the conference. (MCW)

57176 (CTH-JVG—1) Groundwater as a heat source for space heating using a heatpump. Wilen, P. (Chalmers University of Technology, Goeteborg (Sweden). Earth Heat Pump Group). May 1981. 42p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750475.

This review article is based on a literature study on heat pump systems using ground water as the heat source. The report describes some different heat pump systems; relates operational experiences, costs and research in progress.

57177 (CTH-JVG—2) Heat pump with vertical ground heat collectors and wind convectors. Evaluation of a full scale project in Utby 1979-1981-06-03. Franck, P.A.; Modin, B.; Rosenblad, G. Sep 1981. 73p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82750463.

Experiences from two years operation of a ground and air source heat pump system in a one family house are reported. Detailed statistics of energy balances soil, brine and ambient air temperatures etc are given. The soil freezing around the vertical tube heat collectors was also studied.

57178 (DOE/BP—128) Conditional demand approach to appliance-usage estimates for single-family homes in the Pacific Northwest. Scanlon, T.; Hoffard, D. (USDOE Bonneville Power Administration, Portland, OR). Jan 1982. 47p. NTIS, PC A03/MF A01. Order Number DE82020256.

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Specifications which characterize total household demand as the summation of demand for individual end-use categories, contingent on the households' specific appliance portfolio and consumption history, have been referred to as conditional demand specifications. The efforts involved in deriving annual appliance usage estimates and related elasticities within a conditional demand framework for single-family homes in the Pacific Northwest region are documented here. The theoretical framework of the model is presented. The regression equations and their results are also given. In addition, an explanation of the data base and the software package used is provided. The common problems associated with conditional demand specifications are outlined, and the results of previous studies are provided as a basis of comparison for the results obtained.

57179 (DOE/NBB—0011-Vol.1) TI-59 program for calculating the annual energy requirements for residential heating and cooling. Volume I. Users manual. Costello, F.A.; Kusuda, T.; Aso, S. (National Bureau of Standards, Washington, DC (USA)). Jul 1982. Contract AI01-76PR06010. 132p. NTIS, PC A07/MF A01. Order Number DE82020274.

This report comprises the program documentation and user's manual for the TI-59 pocket calculator program for determining annual heating and cooling energy consumption of residential buildings. The program embodies the Variable-Base-Degree-Day Method, which has been proven to yield equivalent results as obtained by the comprehensive hour-by-hour simulation calculation, such as DOE-2. Given in this report are step-by-step calculation procedure information on input data, sample calculations, and mathematical basis of the procedure.

57180 (DOE/NBB—0011-Vol.2) TI-59 program for calculating the annual energy requirements for residential heating and cooling. Volume II. Program reference manual. Kusuda, T.; Costello, F.A.; Liu, S.T.; Barnett, J.P. (National Bureau of Standards, Washington, DC (USA)). Jul 1982. Contract AI01-76PR06010. 235p. NTIS, PC A11/MF A01. Order Number DE82020275.

Portions of document are illegible.

This volume provides basic mathematical formulation, program listing, input data for the subject pocket calculator energy analysis procedure. The data include solar and surface weather parameters, degree-days to variable bases, sunlit factors and earth temperature.

57181 (EPRI-EM—2319) Northern-climate heat-pump field-performance evaluation. Final report. Reedy, W.R.; Bullock, C.E. (Carrier Corp., Syracuse, NY (USA). Research Div.). Jul 1982. 86p. NTIS, PC A05/MF A01. Order Number DE82905832.

The field data and related analysis for four residential and one commercial heat pump installation are presented. Results that cover both heating and cooling operation are presented for an initial period of one year. Additional results reflecting changes in heat pump equipment and controls are presented for selected sites. The results of this program are of interest to electric utility representatives in need of quantitative heat pump performance data. The building structures, the associated heat pumps, and the instrumentation system used to record the performance data are described. Data summaries are then presented which quantify the actual operating characteristics and performance of these heat pumps in both heating and cooling modes of operation.

57182 (LBL-PUB—448) Computerized Instrumented Residential Audit, version 1.0: source listings. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract AC03-76SF00098. 183p. NTIS, PC A09/MF A01. Order Number DE82019953.

CIRA is a set of computer programs to predict the energy consumption of small buildings. It can also provide an optimized list of improvements which reduce energy use. The source code in BASIC is provided to help a user adapt the program to a particular application, or to see details of the calculation algorithms. (LEW)

57183 (LUTADL/(TABK—1001)/274/(1981)) Housing design in extreme hot arid zones with special reference to thermal performance. Elawa, S. (Lund Inst. of Technology (Sweden). Dept. of Building Science). Nov 1981. 274p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE82750476.

In order to find a suitable design strategy for housing within a extremely hot and arid zone, expecially in Egypt, two approaches are used. Firstly the old islamic buiilding tradition in Egypt is examined and secondly parameter studies together with model studies in windtunnel are carried out. As a basis for the parameter studies a building (room) was chosen, in which wall and roof construction, colours and shading of outer surfaces, window size and orientation as well as ventilation mode and rate were changed. As a result the following design strategies were found: 1. Use ventilation during night and no ventilation during day. 2. Use shaded windows facing normal wind direction or wind catches for night ventilation by natural wind. 3. Use indoor thermal capacity to store the night cool to the following day. 4. Use outside white colour or shading to prevent absorption of solar radiation. 5. Use thermal insulation to prevent heat penetration through walls and roof.

57184 **(NP—2750465) Report on the choice of heating systems.** (Dansk Gasteknisk Forening, Hellerup). 1981. 49p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750465.

Presented at the annual meeting 1981.

Many consulting and management firms are expected to give their opinions about choice of gas or fuel oil heating form in residential semidetached and detached houses. This report is meant to give brief guideline in economic and technical reasons for fuel choice. Brickhouses with oil furnace will probably have to convert to natural gas by exchanging only the oil burner for a gas injection burner (for newer heating systems). Heating efficiency and economic calculations are drafted for various house constructions, appartment buildings, cellars etc. depending on forecasted energy consumption.

57185 **(NP—2906167) Coastal energy-conservation policy guidelines.** (New Jersey Dept. of Environmental Protection, Trenton (USA). Div. of Coastal Resources). Jun 1982. 45p. NTIS, PC A03/MF A01. Order Number DE82906167.

After a discussion of New Jersey State energy conservation policies and statutes, active and passive solar designs are reviewed briefly. Building techniques that conserve energy are described, and passive solar construction techniques that use natural processes for heating and cooling are detailed. An energy conservation checklist is included. Solar information agencies are listed that provide professional assistance concerning energy conservation construction techniques. An annotated bibliography on energy conservation is also included. (LEW)

57186 **(ORNL/Sub—80/13816/1) Analysis of the residential-energy-conservation tax credits: concepts and numerical estimates.** (Oak Ridge National Lab., TN (USA); Charles River Associates, Inc., Boston, MA (USA)). Jun 1982. Contract W-7405-ENG-26. 155p. NTIS, PC A08/MF A01. Order Number DE82016572.

The purposes of the study were to develop an analytical framework for examining the effects of residential energy conservation tax credits, to identify the data needed to obtain numerical analyses of these effects, and to provide numerical estimates and sensitivity analyses of these effects. Investment in both energy-saving devices and renewable energy sources is examined. The variables analyzed are: oil import savings, their time path, revenue costs to the U.S. Treasury, and the net economic welfare gain or loss. The results of the study are summarized. (MCW)

57187 **(ORNL/Sub—81-7762/2) Energy characteristics of a two-evaporator refrigerator using a refrigerant mixture. Phase II. Project X01 7762. Final report.** Stoecker, W.F. (Oak Ridge National Lab., TN (USA); Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). Mar 1982. Contract W-7405-ENG-26. 63p. NTIS, PC A04/MF A01. Order Number DE82020488.

Thermodynamic analysis has shown that energy can be conserved in a two-evaporator refrigerator by applying a non-azeotropic mixture of refrigerants in place of a single refrigerant. The two major efforts are: (1) optimization of the distribution of heat-transfer area and of the mixture concentration, and (2) an experimental study to validate the analytical models. The mixture chosen was R12/R114. The optimization showed two local minima of energy consumption, one at 30% R114 and the other at 70% R114 by mass. While the 70% R114 mixture indicated power requirements about 1.4% less than the 30% R114 mixture, the vapor of the 30% R114 mixture is the denser of the two and requires lower compressor displacement. With respect to the distribution of heat-transfer area, the optimization indicated that the area of the low-temperature heat exchanger could be used better in the other heat exchangers. This finding would be viewed favorably from a manufacturing standpoint. The experimental studies consisted of a series of tests of various R12/R114 concentrations and confirmed the progressive change in temperatures of the boiling and condensing refrigerant. The tests were inconclusive in validating the energy conservation possibilities, but uncovered important practical considerations such as the influence of pressure drop in the heat exchangers and the performance of the compressor with the low vapor density that occurs at high R114 concentrations.

57188 **(P—400-00-016) Directory of room air conditioners which comply with November 3, 1979 standards.** (California Energy Resources Conservation and Development Commission, Sacramento (USA); SEE CODE- 9502807 California Energy Commission, Sacramento (USA)). Aug 1981. 23p. NTIS, PC A02/MF A01. Order Number DE82904293.

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This directory of room air conditioners contains information about each model certified by the manufacturer as complying with the regulations that become effective on November 3, 1979. The list is divided by voltage and application. For the purposes of this directory a commercial room air conditioner is defined as one tested as a packaged terminal air conditioner or packaged terminal heat pump. The directory also includes an explanation as to how to use the Federal EnergyGuide labels to help make wise purchases.

57189 **(P—400-81-037) Local ordinances to improve energy efficiency of existing housing: a guide for local governments. Consultant report.** Mott-Smith, J. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Nov 1981. 167p. NTIS, PC A08/MF A01. Order Number DE82903680.

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Encouraging energy conservation in the residential housing stock built before the existence of state energy efficiency building standards is one way for local governments to respond to ever-increasing energy prices and the need to reduce energy consumption in their communities. To stimulate retrofit activity a number of California cities and counties have adopted local ordinances requiring basic weatherization at time of resale. This Guidebook builds on the experience of those communities and serves as a resource for policy makers in other communities considering adoption of retrofit ordinances. The Guidebook suggests three options for the timing of ordinance responsibilities: placing the responsibility on the seller, the buyer, or a combination of buyer and seller responsibilities. Technical issues - such as what measures to include in the ordinance, energy audit vs. energy inventory, and enforcement mechanisms - are discussed. Policy questions that may be raised during the evaluation of the ordinance - economic impact, effects on renters, and mandatory vs. voluntary approach - are included. Model ordinances, key contact persons, pending statewide legislation, and utility and realtor position statements are included in the Appendix.

57190 **(PB—82-155177) Weatherization retrofitting and occupant comfort. Final report.** Clark, R.E. (National Bureau of Standards, Washington, DC (USA)). 1981. 8p. Proceedings of Nat. Conf. Optimal Weatherization, held at Washington, DC on December 8-10, 1980, Paper in Optimal Weatherization, p60-67, 1981.

This report discusses preliminary findings of a field study of occupant comfort impressions in weatherized houses. The data covered: (1) thermostat setting practices; (2) comparative amounts of clothing worn; (3) direct report of comparative comfort, (4) comfort ratings (on a five-point scale) and temperature ratings (on the ASHRAE seven-point scale).

57191 **(PB—82-158676) Retrofit '78: a regional conference on community-based retrofit programs for New England held in Durham, New Hampshire, December 15-16, 1977.** Goldberg, D.H. (Citizen Involvement Network, Washington, DC (USA)). 1978. 55p. NTIS, PC A04/MF A01.

Conference papers on community based retrofit programs are presented by citizen leaders from six New England states. The papers are based on prior information on home insulation techniques, programs, and financing. The national energy problem and energy outlook are discussed. Basic weatherization concepts and terminology and ways to determine weatherization needs are given. Explanations are supplied of adhesive vinyl based foam stripping, felt weatherstripping, vinyl tubing, v-shaped metal stripping, mineral wool insulation, and loose fill insulation. The importance of properly installing insulation is emphasized, as is the usefulness of an energy audit. Existing Federal programs which provide funds for retrofit are listed and pending legislation is examined. The possibility of bank financing is also explored. Solar retrofit programs are introduced and a bibliography on solar systems is included.

57192 (PB—82-169681) Energy efficiency improvement of residential and commercial gas appliances, Phase II. Final report Dec 79-Jun 81. Peterka, D.L.; Larson, T.C.; Erickson, R.C. (Science Applications, Inc., La Jolla, CA (USA)). Jan 1982. 159p. (SAI—444-81-202-LJ). NTIS, PC A08/MF A01.

A review of commercial gas appliance technology previously conducted in Phase I resulted in identification of candidate appliance efficiency design concepts for development. In the Phase II activities, a competitive procurement was prepared resulting in a contract award to Advanced Mechanical Technology, Inc. (AMTI) to design and build an advanced energy-efficient prototype commercial water heater in a phased RDandD program. A preliminary market survey was conducted which included retailers, consumers, and manufacturers of commercial water heaters. The major goals of the survey were to determine acceptable cost increments, payback periods, add marketing avenues, as well as to determine the current attitudes about commercial water heaters. A parametric market penetration model was also developed to predict market shares as a function of payback period and first cost premiums. The model accounts for consumer behavior as determined from the surveys as well as the barriers identified.

57193 (PB—82-170069) Development of an energy test method for a dedicated water-heating pump. Wan, C.A.; Palla, R.L. Jr.; Harris, J.E. (National Bureau of Standards, Washington, DC (USA)). Jan 1982. 54p. (NBSIR—81-2372). NTIS, PC A04/MF A01.

Modifications of the DOE test procedure for water heaters Uniform Test Method for Measuring the Energy Consumption of Water Heaters were made to include a dedicated water heating pump, system equipped with a 50 gallon electric water heater tank. Also presented are laboratory tests and results which provided the basis for the test methods used. Tests included determination of recovery efficiency, standby loss, and water heater jacket loss -- all under static or no-draw conditions -- and a dynamic test in which water is withdrawn according to a 'typical-use' schedule. Energy requirements predicted by the proposed (static) procedure were in good agreement with measured energy consumption for the dynamic test in limited testing.

57194 (PB—82-172495) Light pipes for illumination purposes, a preliminary study. Frederiksen, E. (Lysteknisk Lab., Lyngby (Denmark)). Nov 1980. 65p. (In Danish). NTIS, PC A04/MF A01.

The purpose of this project was to outline the possibilities and problems involved in using daylight, and especially sunlight, for indoor illumination with the help of light pipes. The dimensions of such pipes are more like those of ventilation ducts than of electric cables, for example. The most effective sunlight collector must contain a reflector capable of rotating around 2 axes, so that the sun's movement can be followed quite closely. It can be said that the effective area of a collector must be approx. 1/30th of the area to be illuminated. A light pipe system is a combined sunlight and artificial light system, replacing a conventional system and providing general illumination rather than illumination for work areas. It is concluded that it is technically possible to illuminate rather large buildings with sunlight collected with sunlight collectors and conducted around in the building with light pipes. However, because of the cost of sunlight collectors, the economic advantages of solar illumination systems are dubious. A bibliography is included.

57195 (PB—82-174517) Some practical aspects on the infra-red thermography of buildings. Siviour, J.B. (Electricity Council Research Centre, Capenhurst (UK)). Oct 1981. 23p. (ECRC/M—1483). NTIS, PC A02/MF A01.

Infra-red thermography has been used to obtain scans of internal and external surface temperatures of houses. In general, the interpretation of the pictures in color is straightforward, but there are limitations which have to be understood. When used outside a building, direct and residual effects of the sun on external surfaces can be significant. Reflection occurs at high angles of incidence, so that for example, when viewing a pitched roof from the ground sunlight may be reflected from the roof into the infra-red camera. Also heat from the sun may be stored in walls for many hours. Inside a building cold spots may be due to the high heat loss from thermal bridges to the outside or to low local heat loss arising from cold air infiltration.

57196 (PB—82-175126) Annual housing survey: 1978. United States and regions. Part F. Energy-related housing characteristics. (Bureau of the Census, Washington, DC (USA)). Aug 1981. 372p. NTIS (US Sales Only)MF A01.

This report presents statistics on energy - related housing characteristics from the 1978 Annual Housing Survey for the United States by inside and outside standard metropolitan statistical areas. Tables provide data on fuel, fuel cost, heating, air conditioning, insulation, and transportation characteristics. In addition, they present figures on the income of families and individuals by energy - related housing characteristics; the value of owner - occupied housing units and the gross rent of renter - occupied housing units by energy - related housing characteristics; the monthly and yearly costs paid for utilities; and the number of rooms per housing unit by energy - related housing characteristics. Data on energy - related housing characteristics are also given for Black and Spanish heads of households. Appendices describe the geographic area classifications; provide definitions and explanations of the subjects covered in the report; and present information on sample design, estimation, and accuracy of the data. Area maps are included.

57197 (PB—82-175266) Energy conservation in buildings: an economics guidebook for investment decisions. Marshall, H.E.; Ruegg, R.T. (National Bureau of Standards, Washington, DC (USA)). May 1980. 151p. NTIS PC MF A01.

For architects, engineers, builders, and others concerned with the design and operation of buildings, this guidebook provides principles, techniques, step - by - step illustrations, and sample problems on how to evaluate the economics of energy conservation and solar energy investments. Techniques of economic evaluation are described, including life - cycle costing, net benefits, savings - to - investment ratio, internal rate - of - return, and discounted payback analyses. The techniques are compared in terms of their advantages and disadvantages. Discounting, a procedure for taking into account the time value of money, is illustrated in the analysis of an investment in heat pumps. Practice problems for discounting and for applying each of five techniques are presented. Factors that affect benefits and costs, including time horizons, discount rates, inflation, incentives, taxes, salvage values, and measures of uncertainty are discussed, and guidance is provided for selecting appropriate values for these factors when making economic evaluations. Comprehensive case illustrations for solar heating and for window design management are described. Appendices provide tables and formulas for evaluating the economics of alternative conservation investments and a glossary of economic terms. Footnotes, additional tables, and 25 references are supplied.

57198 (PB—82-175779) Mobile home air conditioning and energy consumption test: zone 1. Final report. Wiggins, D.B.; Ingley, H.A. (Florida Univ., Gainesville (USA). Solar Energy Lab.). Apr 1980. 255p. NTIS, PC A12/MF A01.

Since energy use and conservation are of prime importance, this study's overall objective was to investigate problems associated with mobile home air conditioning in the Zone I climate region, which is a warm temperature / high humidity area. Under contract with HUD, the University of Florida Solar Energy and Energy Conversion Laboratory purchased, instrumented, and evaluated two mobile homes during 1978. One home was a 56 foot by 14 foot Skyline and the other was a 56 foot by 24 foot Guerdon. Extensive instrumentation provided data that indicate strong unsteady state thermal behavior due to solar gains and changing ambient conditions. The data also show the existence of high infiltration rates which may be an integral part of this unsteady state behavior. The air distribution systems studied were found to be functionally acceptable, but several problem areas were identified. For example, the duct systems were not insulated but merely placed within the insulated basement cavity. Under - floor ducts should be wrapped within a R - 4 insulation material and have a vapor barrier as an outer covering. Also, mobile home manufacturers do not provide specific locations for the attachment of external air conditioning ducts. Tests for sound levels, indicated that although levels were high, they were all within acceptable levels. Infrared photography studies revealed heat leakage at several locations on the houses. The air conditioning systems were determined to be operating at rated efficiencies. However, accurate load data for Zone I mobile home construction was not provided by the standards manual used. On the basis of these findings, recommendations are made for changes in the language of HUD's Mobile Home Construction and Safety Standards, Subparts F and H. Graphs, diagrams, tables, photographs, and worksheets are supplied.

57199 (PB—82-175902) Constructing earth sheltered housing with concrete. Spears, R.E. (Portland Cement Association, Skokie, IL (USA). Buildings Div.). 1981. 44p. NTIS, PC A03/MF A01.

This manual provides a state - of - the - art review of the design and construction of an earth - sheltered house using cast - in - place concrete, precast concrete, and concrete masonry. Based on a literature survey, theoretical work, and discussions with researchers and engineers in the concrete industry, the text is designed for use by architects, engineers, and homebuilders. The features of concrete construction that are current accepted practice for the concrete products discussed are shown to be applicable with reasonable care to building a safe, dry, and comfortable earth - sheltered house. The main considerations underlying the recommendations were the use of the earth's mass and passive solar effects to minimize energy needs, the structural capacity of the separate concrete products and their construction methods, and drainage principles and waterproofing details. Shelter ranging from those with at least 2 feet of earth cover to those with an uncovered roof of usual construction are included. To be considered an earth - sheltered residential building, at least half of the exterior wall and roof area that is in direct contact with the conditioned living space must be sheltered from the environment by earth berm or earthfill. Siting considerations, the fundamentals of passive solar heating, planning considerations, and structural considerations are discussed. Detailed guidelines are provided on concrete masonry construction, joint details in walls and floors, waterproofing, formwork and form removal, concrete construction practices, concrete masonry, and surface finishes. Numerous illustrations, tables, and a list of 32 references are provided. (Author abstract modified).

57200 (PB—82-180258) Evaluation of the ORNL residential energy use model. Final report. McFadden, D. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1981. 152p. (MIT-EL—81-021). NTIS, PC A08/MF A01.

This report provides an evaluation of the architecture, empirical foundation, and applications of the Oak Ridge National Laboratory (ORNL) residential energy use model. A particular effort is made to identify the strengths and shortcomings of the model for alternative uses, and to identify areas where model structure and empirical support could be upgraded. Concrete suggestions are made for improvements in model logic, strengthening the empirical basis for behavioral and technical parameters, and reducing the biases in the model arising from aggregation. The overall conclusion is that the model has the potential to provide adequate forecasts of the aggregate impacts at a regional or national level of policies whose effects on households are relatively homogeneous.

57201 Life-cycle cost analysis of major appliances. Turiel, I.; Estrada, H.; Levine, M. (Univ of Calif, Berkeley). *Energy (Oxford);* 6: No. 9, 945-970(Sep 1981).

The Department of Energy has proposed energy efficiency standards for eight types of appliances. One of the criteria used to establish these standards is the economic impact of the standard on the consumers of the regulated products. A life-cycle cost analysis was performed for 32 classes of these eight appliances in order to gain a measure of the economic impact of equipment purchases on the consumer. Simple payback times were also computed to indicate how much time is required for the consumer to recapture his or her initial added investment in a more efficient product. Using national average energy use for each appliance type, it was found that the proposed 1986 standards are cost-effective with respect to the energy efficiency levels projected to occur in the absence of standards for all classes of products. Simple payback periods range from several months for refrigerators and freezers to a maximum of 5.3 years for split system central air conditioners. 8 refs.

57202 (ECN-ESC—5-SAM) Energy saving, how is it possible. A social-psychological study of the promotion of energy saving through behavior influence in family households. (Stichting Energieonderzoek Centrum Nederland, Petten). Feb 1981. 54p. (In Dutch). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82902708.

Portions of document are illegible.

A research project was undertakren on the effectiveness of behaviour change strategies to influence the energy use in family households. An overview is presented of the three different approaches to behaviour change: information, the approach based on learning principles, and the coercive approach. A field experiment was carried out in which the effects of four strategies were tested. These strategies were: (1) general information about how to conserve energy in the home; (2) weekly feedback with respect to the magnitude and financial consequences of the own energy use; (3) weekly feedback with respect to the magnitude and financial consequences of the own energy use compared with the use of people in comparable conditions (same houses); and (4) weekly feedback (comparative) and financial reinforcement for decreases in energy use. The results indicate that the individual feedback and financial reinforcement and feedback is effective under certain conditions and that the general information seems hardly effective. The results were also related to the attitudes of the residents towards energy conservation.

57203 (PB—82-161472) Energy saving effects in dwellings where measures have been implemented by governmental energy saving grants. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1981. Translation of Swedish monograph. 185p. NTIS, PC A09/MF A01.

This report presents the results from a comprehensive investigation of how groups of particular energy-saving measures affect energy consumption for the heating of residential buildings.

57204 Case for electricity: an applications approach. Asbury, J.G. (Argonne National Lab., IL). pp 51-58 of Business and economic statistics. Washington, DC; American Statistical Association (1981).

One of the most important developments in energy supply in recent years is the greatly improved price-competitiveness of electricity. Although the price of electricity has increased in both nominal and real terms over the past decade, the increases have been relatively modest compared with those of other energy forms. The rise in the real price of electricity has been smallest in the residential market where the fuel component of cost of electric supply is proportionately less than in the commercial and industrial markets. A study of the residential market for electricity was performed. Statistical data were analyzed to establish consumer response to differences in electricity and competing-fuel prices. The basic finding was that the consumer is extremely price-conscious; all available data are consistent with the rational behavior hypothesis. The study analyzed the total costs of installing and operating alternative after-the-meter technologies for electric heating and cooling and compared these costs with oil- and natural gas-based systems. Electricity was found to enjoy a significant cost advantage relative to the competing energy forms, if the local utility can meet its intermediate- and base-load needs with coal and/or nuclear generating plants. The importance of peak-load pricing to expanding the use of electricity in the building heating market is discussed.

57205 Thermal performance of buildings and building envelope systems: an annotated bibliography. Carroll, W.L. (Univ of California, Berkeley). *American Society for Testing and Materials, Special Technical Publication;* No. 718, 114-141(1980). (CONF-7810283—).

From Thermal insulation performance symposium; Tampa, FL, USA (22 Oct 1978).

A bibliography of 181 published papers describing models, measurement techniques, apparatus, and data for the thermal performance of whole buildings and building envelope systems has been collected. Summary descriptions of the content of each citation are provided.

57206 Model of household fuel uses. Hirst, E. (Oak Ridge Natl Lab, Tenn, USA). *Simulation Councils Proceedings Series;* **8**: No. 1, 59-67(Jun 1978).

A detailed computer model of household fuel uses was developed to assist in the evaluation of alternative conservation policies, programs, and technologies affecting energy use in homes. The model provides details on annual energy uses by fuel, end use, and housing type. 13 refs.

57207 (PB—82-180852) Development of domestic heat pumps. Final report. McMullan, J.T.; Morgan, R. (Commission of the European Communities, Luxembourg). [nd]. 124p. (EUR—7098-EN). NTIS PCE06/MF E06.

The program was aimed at developing a control strategy for domestic heat pumps. The experimental measurements were conducted in a controlled environment laboratory matching outdoor conditions. Experimental and theoretical modelling showed that the probable contribution of the latent heat of air-borne water to the evaporator heat pick-up lies between 10% and 13%. Investigation of the effect of refrigerant turbulence showed that the degree of turbulence was high, but that tube-wall dryout did not occur at any point in the evaporator. When this factor was coupled with the observation that saturation pressure and temperature differed from published refrigerant data, it was realized that the lubricant was playing an important role. This was investigated. The economic analysis of the field tests showed that under the conditions pertaining, the heat pump has a likely payback period of 2 1/2 years compared with a new oil-fired system.

57208 (NP—2903914) Commercial energy audit workbook with energy conservation retrofit measures. Otterbein, R.T. (Arizona Energy Office, Phoenix (USA)). [nd]. 46p. NTIS, PC A03/MF A01. Order Number DE82903914.

The first Commercial Energy Audit Workbook presented building owners and managers information on how to conduct a brief, but thorough energy audit of their buildings. This follow-up workbook is designed to help building owners and managers further evaluate building energy use. It is a compromise between a sophisticated computer simulation and a brief walk-through audit. Background information explains how and where energy is used in the building. How to compile building data is described. Measures to identify areas of intense energy use in the building are described. Some retrofit measures are listed that are potentially cost effective. Also presented is a method to calculate energy cost savings and rank retrofit measures according to simple payback period.

3202 Transportation

REFER ALSO TO CITATION(S) 56080, 57128, 57233, 57248, 57248, 57285, 57291, 57296

57209 (AD-A—109044/8) A review of aircraft cabin conditioning for operations in Australia. Rebbechi, B. (Aeronautical Research Labs., Melbourne (Australia)). Oct 1980. 80p. NTIS, PC A05/MF A01.

A review is presented of aircraft cabin conditioning. This review has been undertaken because of the inadequate performance of many aircraft air conditioning systems in the hottest conditions encountered in Australia. The factors included in this study were the climatic conditions (both Australia and world-wide), human performance in hot conditions, the heat balance of aircraft cabins, cooling system performance, and specification of cabin environment control systems. It is concluded that climatic conditions in Australia are not severe in a world-wide context, and that there is no technological reason why the cabin conditioning systems of aircraft should be inadequate. Compliance with present RAAF specifications will provide an acceptable cabin environment for operation of aircraft in Australia.

57210 (AD-A—109393/9) Urban traffic signal control for fuel economy. Part 2. Extension to small cars. Messenger, G.S. (National Research Council of Canada, Ottawa, Ontario). Nov 1981. 13p. NTIS, PC A02/MF A01.

Use of a small car's characteristics in a simulation program utilizing velocity profiles obtained in a traffic study by the Metropolitan Toronto Roads and Traffic Department and the Engine Laboratory at the National Research Council Canada has shown that trends shown in fuel consumption in NRC, Division of Mechanical Engineering Report No. ME-247 are similar for a small-engined vehicle. NRC, DME Report No. ME-247 showed that under the TRANSYT timing plan vehicles encountered fewer stops, saved time and used a slightly smaller amount of fuel than under the existing timing plan. In the report, a large vehicle's fuel consumption was calculated using a computer model of the vehicle which used velocity profiles obtained from an instrumented floating car.

57211 (DOE/CS/50188—T1) Voluntary Truck and Bus Fuel-Economy-Program marketing plan. Final technical report, September 29, 1980-January 29, 1982. (Coleman and Christison, Inc., St. Paul, MN (USA)). 1982. Contract AC01-80CS50188. 280p. NTIS, PC A13/MF A01. Order Number DE82015093.

Portions of document are illegible.

The aim of the program is to improve the utilization of fuel by commercial trucks and buses by updating and implementing specific approaches for educating and monitoring the trucking industry on methods and means of conserving fuels. The following outlines the marketing plan projects: increase use of program logo by voluntary program members and others; solicit trade publication membership and support; brief Congressional delegations on fuel conservation efforts; increase voluntary program presence before trade groups; increase voluntary program presence at truck and trade shows; create a voluntary program display for use at trade shows and in other areas; review voluntary program graphics; increase voluntary program membership; and produce placemats carrying fuel conservation messages; produce a special edition of Fuel Economy News, emphasizing the driver's involvement in fuel conservation; produce posters carrying voluntary program fuel conservation message. Project objectives, activities, and results for each project are summarized.

57212 (DOE/NASA—2817-3) Fuel-economy and exhaust-emissions characteristics of diesel vehicles: test results of a prototype Chrysler Volare, 225 CID (3.7-liter) automobile. Walter, R.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Jul 1982. Contract AI01-80CS50194. 44p. (NASA-CR—167925; DOT/TSC/NASA—82-3). NTIS, PC A03/MF A01.

The results obtained from fuel economy and emission tests conducted on a prototype Chrysler Volare diesel vehicle are documented. The vehicle was tested on a chassis dynamometer over selected drive cycles and steady-state conditions. The fuel used, was a DOE/BETC referee fuel. Particulate emission rates were calculated from dilution tunnel measurements and large volume particulate samples were collected for biological and chemical analysis. The vehicle obtained 32.7 mpg for the FTP urban cycle and 48.8 mpg for the highway cycle. The emissions rates were 0.42/1.58/1.17/0.28 g/mile of hydrocarbon, CO, NO/sub x/ and particulates respectively.

57213 (NP—2904112) Legislation relating to energy conservation. 1981 Senate Bill 566: relating to precluding employees participating in ride-sharing arrangements from recovery under the Worker's Compensation Act. (Wisconsin Legislative Council Staff, Madison (USA)). 4 Dec 1981. 14p. (RL—81-23). NTIS, PC A02/MF A01. Order Number DE82904112.

The Wisconsin State Bill 566 relating to precluding employees participating in ride-sharing arrangements from recovery under the Worker's Compensation Act is discussed. The history of the Special Committee on Energy Conservation, one task which was to develop short- and long-term strategies for minimizing the total consumption of petroleum for the transportation of persons and property in Wisconsin, including the feasibility of using a railroad service to transport automobiles traveling for recreational purposes, is covered. A list of materials prepared by staff and others distributed to the Committee and its Subcommittee on Transportation is given. (MCW)

57214 (ORNL/EIS—198) Publications of the Transportation Systems Utilization Division: a bibliography. Newman, B.G.; Weaver, R.S.; Alford, A.C.; Guthrie, M.P. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 169p. NTIS, PC A08/MF A01. Order Number DE82020705.

This annotated bibliography is an inventory of the information products of the US Department of Energy's Transportation Systems Utilization (TSU) Division and is intended as a permanent record of the Division's publications. The period of time covered by this bibliography is that of the existence of the Transportation Systems Utilization Division, from 1974 to 1981. The eight major program areas of TSU have been: (1) New Car Fuel Economy Information, (2) Driver Energy Conservation Awareness, (3) Voluntary Truck and Bus Fuel Economy, (4) Non-Highway Research and Development, (5) State and Local Technical Assistance, (6) Freight and Intercity Passenger, (7) Ridesharing, and (8) Contingency Planning. All research and outreach products identified by the program managers for these TSU interest areas are included in this bibliography.

57215 (PB—82-150426) The effect of light truck design variables on top speed, performance, and fuel economy, 1981. Final report Oct 80-Sep 81. Zub, R.W.; Meisner, R.P. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Nov 1981. 103p. (DOT-TSC-NHTSA—81-22). NTIS, PC A06/MF A01.

The effect of vehicle weight, rolling resistance, aerodynamic drag, and drive-line configuration on fuel economy and performance for light duty trucks is examined. The effect of lockup and extended gear ratio range is also investigated. The assessment of these vehicle variables on fuel economy and performance is determined by using the Transportation Systems Center's vehicle simulation program, VEHSIM, which predicts fuel economy and performance for vehicle parameter changes. The results indicate fuel economy and performance trends which can be used to project future improvements.

57216 (PB—82-153065) Traffic performance measurement. Information bulletin. (Public Technology, Inc., Washington, DC (USA)). Jul 1978. 24p. NTIS, PC A02/MF A01.

This bulletin relates traffic performance measurement to local urban goals and objectives. It describes ways of measuring traffic performance against locally developed standards, and their impact on broader urban concerns, such as energy conservation and air quality.

57217 (PB—82-154105) Transportation system management, air quality, and energy conservation. Information bulletin. (Public Technology, Inc., Washington, DC (USA)). Sep 1980. 86p. NTIS, PC A05/MF A01.

This information bulletin explores Transportation Systems Management (TSM) issues and problems, such as mandates for TSM, Air Quality and Transportation, Energy TSM, TSM Goals and Trade-offs, Effectiveness of TSM Strategies, Planning and Implementing TSM, and Local Government concerns in formulating TSM plans. This Information Bulletin also contains a list of a cross-section of important general contracts and programs as a starting part for more detailed inquiries, as well as an Annotated Bibliography for the readers' future reference.

57218 (PB—82-163783) Interim assessment of the VAL automated guideway transit system. Interim report. Anagnostopoulos, G. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Nov 1981. 199p. (DOT-TSC-UMTA—81-34). NTIS, PC A09/MF A01.

This report describes an interim assessment of the VAL (Vehicules Automatiques Legers or Light Automated Vehicle) AGT system which is currently under construction in Lille, France, and which is to become fully operational in December 1983. This report contains a technical description and performance data resulting from a demonstration test program performed concurrently in August 1980. VAL is the first driverless AGT urban system application in France. The system operates at grade, elevated, and in tunnels on an exclusive concrete dual-lane guideway that is 12.7 kilometers long. The configuration of the system is a push-pull loop operating between 17 on-line stations. The system is designed to provide scheduled operation at 60-second headways and a normal one-way capacity of 7440 passengers per hour per direction with 55 percent of the passengers seated. Two pneumatic-tired vehicles are coupled into a single vehicle capable of carrying 124 passengers at line speeds of 60 km/hr. During the course of the demonstration test program, VAL demonstrated that it could achieve high levels of dependability and availability and could perform safely under all perceivable conditions.

57219 (PB—82-164575) A computer program (HEVSIM) for heavy duty vehicle fuel economy and performance simulation. Volume I: Description and analysis. Final report Mar-Oct 80. Buck, R.E. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Sep 1981. 26p. (DOT-TSC-NHTSA—81-14-1; DOT-TSC-UMTA—81-19-1). NTIS, PC A03/MF A01.

This report presents a description of a vehicle simulation program, which can determine the fuel economy and performance of a specified motor vehicle over a defined route as it executes a given driving schedule. Vehicle input accommodated by HEVSIM include accessories, engine, rear axle, converter, transmission, tires, aerodynamic drag coefficient, and shift logic. The report consists of three volumes. Volume I presents a description of the numerical approach and equations, Volume II is a user's manual, and Volume III contains the program listings.

57220 (PB—82-164583) A computer program (HEVSIM) for heavy duty vehicle fuel economy and performance simulation. Volume II: Users' manual. Final report Mar-Oct 80. Buck, R.E. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Sep 1981. 78p. (DOT-TSC-NHTSA—81-14-2; DOT-TSC-UMTA—81-19-2). NTIS, PC A05/MF A01.

Volume II is the second volume of a three volume document describing the computer program HEVSIM for use with buses and heavy duty trucks. This volume is a user's manual describing how to prepare data input and execute the program. A strong effort has been made to prepare this manual from a user's viewpoint. Sample cases have been included to illustrate the various simulation methods available, and the most frequently used HEVSIM options.

57221 (PB—82-164591) A computer program (HEVSIM) for heavy duty vehicle fuel economy and performance simulation. Volume III: Appendices A through F. Final report Mar-Oct 80. Buck, R.E. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Sep 1981. 319p. (DOT-TSC-NHTSA—81-14-3; DOT-TSC-UMTA—81-19-3). NTIS, PC A14/MF A01.

Volume III is the third and last volume of a three volume document describing the computer program HEVSIM. This volume includes appendices which list the HEVSIM program, sample part data, some typical outputs and updated nomenclature.

57222 **(PB—82-176918) Strategic perspective on public transportation in a time of uncertain petroleum supply. Research report (final).** Bruck, H.W.; Garrison, W.L.; Reinhardt, N.; Skiles, M. (California Univ., Berkeley (USA). Inst. of Transportation Studies). Jun 1981. 117p. NTIS, PC A06/MF A01.

The study presents a strategic analysis of the petroleum situation and how it will affect travel behavior and public transportation in general. Scenarios reflecting the manner in which the petroleum situation is most likely to evolve and affect urban public transportation during the coming twenty years are developed. Examination of the factors affecting petroleum supply indicates that pricing of petroleum fuel and timing of implementation of substitute technologies are likely to be the critical determinates of fuel availability. Five scenarios representing alternate possible directions of development of the petroleum situation are presented.

57223 **(PB—82-180431) Measures to restrict the energy consumption in the transport sector.** Miujen, L.G.M. (Studie- en Informatiecentrum TNO voor Verkeers- en Vervoesonderzoek, Delft (Netherlands)). Jun 1979. 162p. (In Dutch). NTIS, PC A08/MF A01.

The report discusses in detail some 350 specific measures to reduce energy consumption in the transportation sector. To provide an impression of the coverage, a number of these measures are listed: relocation of enterprises to reduce transport requirements; increase in density in zoning; elimination or decrease of fiscal deductability of travel expenses; introduction of a 4 day work week; improvement of car and truck engines; restriction of energy-consuming options in cars; research and development of alternative vehicle engines; production of smaller cars; reduction of taxation for car pooling; creation of parking facilities and reservation of lanes for car pools; subsidization of public transport; improvement of quality of service of public transport; introduction of toll roads; taxes on peak hour travel; speed limit; limit on highway construction; parking levies; parking limitation; introduction of gasoline coupons; limiting number of gasoline stations; and measures to restrict the energy consumption in the transport sector.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 56031, 56153, 56153, 56187, 56327, 56455, 56462, 56526, 57021, 57060, 57128, 57191, 57277, 57813, 57930

57224 (CONF-8109156—, pp 23) **Critical metals conservation, recycling and substitution.** Bradley, E.F. (Pratt and Whitney Aircraft). Jan 1982. NTIS, PC A02/MF A01.

From 53. meeting of the AGARD structures and materials panel; Noordwijkerhout, Netherlands (27 Sep 1981).

Critical metals are reviewed relative to their current importance to the aerospace industry. The roles of conservation, recycling, substitution, stockpiling and market place operations are analyzed. Technologies are discussed relative to their effects on the critical metals, and finally, suggestions are presented for meeting material supply problems.

57225 **(DOE/ID/12138—1) Workshop on an assessment of gas-side fouling in fossil-fuel-exhaust environments.** Marner, W.J.; Webb, R.L. (eds.). (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Jet Propulsion Lab., Pasadena, CA (USA)). Jul 1982. Contract AI07-80ID12138. 153p. (JPL-PUBL—82-67). NTIS, PC A08/MF A01. Order Number DE82020691.

A workshop has been carried out to assess the state-of-the-art of gas-side fouling in fossil fuel exhaust environments. Special emphasis was placed on heat recovery applications. For purposes of discussion, the workshop was organized into four different groups as follows: Characterization of Fossil Fuel Exhaust Gases, Gas-Side Fouling Characteristics and Mechanisms, Design of Heat-Transfer Equipment for Gas-Side Fouling Service, and Operation and Cleaning of Heat-Transfer Equipment in Dirty Gas Environments. Edited transcripts of the most important presentations at the workshop are presented, including brief state-of-the-art assessments and a list of specific R and D projects. The following seven projects were identified by the participants as being of the highest priority: Characterization of Fossil Fuel Exhaust Gases; Development of a Gas-Side Fouling Measuring Device; A Study of Attachment and Removal Mechanisms and Predictive Methods for Gas-Side Fouling; Collection of Empirical Gas-Side Fouling Data for Specific Geometries; Effectiveness of Cleaning Devices for Gas-Side Fouling Service; The Mechanism of Wet Wall Fouling in Fossil Fuel Exhaust Gases; Alternative Types of Heat Exchange Equipment to Enhance Heat Transfer and to Mitigate the Effects of Gas-Side Fouling. A short economic analysis shows that the cost of gas-side fouling on equipment alone to recover 2 quadrillion Btu/year in the United States would be $3 billion, with an additional penalty of $1 billion/year for maintenance costs. An extensive bibliography includes about 175 references related to gas-side fouling in heat recovery applications.

57226 **(EUR—7387-DE) Technical and economic possibilities for waste heat utilization in aluminium production.** Kipping, D. (Commission of the European Communities, Luxembourg). 1981. 132p. Commission of the European Communities, Luxembourg.

In the framework of a research project, measurements and evaluations of energy balances of real production systems have been carried out in a plant of Vereinigte Aluminium-Werke AG, the Lippewerk at Luenen/Westphalia, with the aim of obtaining information of general relevance for the aluminium industry. Studies have been carried out in different digestion pipe systems, a calcinating rotary kiln, the power plant, the concentrator, and the foundry. With the data obtained, energy consumption and energy use could be determined on a long-term basis. To get a better picture, the data are presented in Sankey-diagrams. Various possibilities of heat recovery are presented. It is found that integrated, central systems are not profitable at the moment. This means that energy can be saved only by optimisation of sub-processes as shown in some examples.

57227 **(PB—82-149923) Resource Conservation Recovery Act notification file. Data file.** Glazer, A.; Daly, B.; Rivinus, D. (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). Nov 1981. mag tape, vp. NTIS.

This file contains data compiled for the Resource Conservation Recovery Act. Notification of Hazardous Waste Activity, EPA Form 8700-12 was used to collect the data. The file will be updated with information compiled from the Application for a Hazardous Waste Permit, EPA Form 3510-3. The data on this file will be printed by the Government Printing Office in December 1982 with data compiled as of November 1981. There will be a separate volume for each region with Region I numbered SW 987.1 through Region X as SW 897.10. The data includes names and addresses of the facility owner and operator, transportation modes, whether generator or transportor or desposer and the code numbers of wastes generated.

57228 **(PB—82-162116) Energy saving in paper drying. Final report.** Lemaitre, A.; Videau, J.L.; Ramaz, A. (Commission of the European Communities, Luxembourg). 1981. 29p. (EUR—7152-FR). NTIS PC E02/MF E02.

A complete model of a multi-cylinder drier is presented, the main parameters are taken from measurements made at the industrial plant. The utilization of this simulated model, based on operating conditions as defined, enables research into optimum operation under fixed operating conditions to be carried out, especially as regards the extraction of air. The use of high frequency drying should make it possible to reduce profile variations across the width of the web. Its economic benefits ought to be reassessed at frequent intervals in relation to the price of oil and electricity respectively.

57229 **(PB—82-162462) Choice of boiler installation in terms of energy conservation (lecture).** Adam, W. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Mar 1980. 53p. (In Dutch). NTIS, PC A04/MF A01.

Experiences gained in the monitoring of installations are the reasons for examining whether their design allows the most economical fuel consumption. Most installations are economical in terms of investment but not in fuel consumption. Insufficient attention is paid to the effects of several installation technological measures on fuel consumption. Current knowledge is used to estimate fuel consumption for a specific building with several alternative installation designs.

57230 **(PB—82-162488) Energy saving in paper drying. Final report.** Lemaitre, A.; Videau, J.L.; Ramaz, A. (Commission of the European Communities, Luxembourg). 1981. 29p. (In French). (EUR—7152-FR). NTIS PCE03/MF E03.

A complete model of a multi-cylinder drier is presented, the main parameters of which are taken from measurements made on industrial plant. The utilization of this simulated model, based on operating conditions as defined above, enables research into optimum operation under fixed operating conditions to be carried out, especially as regards the extraction of air. The use of high frequency drying should make it possible to reduce profile variations across the width of the web. Its economic benefits ought to be reassessed at frequent intervals in relation to the price of oil and electricity respectively.

57231 **(PB—82-166976) Compendium on low and non-waste technology, monographs 1-20.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). Feb 1982. 289p. NTIS, PC A13/MF A01.

The monographs contain descriptions of process technologies which reduce or eliminate wastes and reduce energy usage. The low and non-waste technologies are described and compared to the conventional technologies that have been replaced. These monographs have been prepared as part of a United Nations Economic Commission for Europe (UNECE) program to promote low and non-waste technology.

57232 **(PB—82-166984) Compendium on low and non-waste technology, monographs 21-46.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). Feb 1982. 285p. NTIS, PC A13/MF A01.

The monographs contain descriptions of process technologies which reduce or eliminate wastes and reduce energy usage. The low and non-waste technologies are described and compared to the conventional technologies that have been replaced. These monographs have been prepared as part of a United Nations Economic Commission for Europe (UNECE) program to promote low and non-waste technology.

57233 **(PB—82-169962) Field performance of littercrete (incinerator residue) in a bituminous base course. Final report June 1974-October 1980.** Erdely, J.; Ledbetter, W.B. (Texas Transportation Inst., College Station (USA)). Sep 1981. 76p. (RF—968-3). NTIS, PC A05/MF A01.

The use of incinerated residue as an aggregate in a bituminous base was studied. A bituminous base utilizing incinerated residue for its aggregate will be termed littercrete in this report. Test sections of an experimental hot mixed littercrete base and a conventional asphalt concrete base (termed control) were placed on a city street in Houston, Texas, and topped with a conventional wearing surface. This report presents the results from field observations and laboratory tests on field core samples during the fourth, fifth, and sixth years of in-service performance of the pavements. This report also evaluates the performance of the pavements during the entire six-year span of the study. Evaluation of the laboratory tests and field observations show that the littercrete is performing essentially the same as the conventional control section. The only distress that has occurred in the littercrete section is minor surface cracking. This cracking is confined to the conventional wearing surface and has not progressed through the littercrete base.

57234 **(PB—82-172388) Auburn, Maine solid waste energy recovery project. Technical bulletin.** (Brown, Vence and Associates, San Francisco, CA (USA)). Apr 1981. 65p. NTIS, PC A04/MF A01.

This technical bulletin is one of a series of reports presenting information gathered in visits to resource recovery facilities around the United States. This study effort has been sponsored by the California State Solid Waste Management Board (CSSWMB). As a number of California resource recovery facilities approach the implementation stage, the CSSWMB has recognized the need to learn from existing projects. In late 1980, five sites were chosen and visited by staff members from Brown, Vence and Associates, consultants to the CSSWMB. These sites included both small and large scale facilities, a number of differing technologies, and projects in varying stages of implementation or operation. The subject of this technical bulletin is the Auburn, Maine modular combustion waste-to-energy project.

57235 **(PB—82-172404) Akron, Ohio recycle energy system project. Technical bulletin.** (Brown, Vence and Associates, San Francisco, CA (USA)). Apr 1981. 72p. NTIS, PC A04/MF A01.

This technical bulletin is one of a series of reports presenting information gathered in visits to resource recovery facilities around the United States. This study effort has been sponsored by the California State Solid Waste Management Board (CSSWMB). As a number of California resource recovery facilities approach the implementation stage, the CSSWMB has recognized the need to learn from existing projects. In late 1980, five sites were chosen and visited by staff members from Brown, Vence and Associates, consultants to the CSSWMB. These sites included both small and large scale facilities, a number of differing technologies, and projects in varying stages of implementation or operation. The subject of this technical bulletin is the Akron, Ohio RDF-dedicated boiler waste-to-energy project.

57236 **(PB—82-172412) Saugus, Massachusetts refuse energy systems company project. Technical bulletin.** (Brown, Vence and Associates, San Francisco, CA (USA)). May 1981. 67p. NTIS, PC A04/MF A01.

This technical bulletin is one of a series of reports presenting information gathered in visits to resource recovery facilities around the United States. This study effort has been sponsored by the California State Solid Waste Management Board (CSSWMB). As a number of California resource recovery facilities approach the implementation stage, the CSSWMB has recognized the need to learn from existing projects. In late 1980, five sites were chosen and visited by staff members of Brown, Vence and Associates, consultants to the CSSWMB. These sites included both small and large scale facilities, a number of differing technologies, and projects in varying stages of implementation or operation. The subject of this technical bulletin is the RESCO waste-to-energy project in Saugus, Massachusetts.

57237 **(PB—82-172420) Energy analysis of secondary material use in product manufacture.** Kunz, R.D.; Emmerson, M.R. (California Solid Waste Management Board, Sacramento (USA)). Nov 1979. 347p. NTIS, PC A15/MF A01.

This study was prepared by the California State Solid Waste Management Board (SSWMB) under contract with the California State Energy Resource Conservation and Development Commission (ERCDC). The funding was made available by the Department of Energy to the ERCDC to support development of California's Energy Conservation Plan. As part of this plan, the report quantifies the savings from energy conservation in California by the efficient management and use of solid wastes and recyclable materials.

57238 **(PB—82-172438) Madison, Wisconsin energy recovery project. Technical bulletin.** (Brown, Vence and Associates, San Francisco, CA (USA)). Jun 1981. 77p. NTIS, PC A05/MF A01.

This technical bulletin is one of a series of reports presenting information gathered in visits to resource recovery facilities around the United States. This study effort has been sponsored by the California State Solid Waste Management Board (CSSWMB). As a number of California resource recovery facilities approach the implementation stage, the CSSWMB has recognized the need to learn from existing projects. In late 1980, five sites were chosen and visited by staff members from Brown, Vence and Associates, consultants to the CSSWMB. These sites included both small and large scale facilities, a number of differing technologies, and projects in varying stages of implementation or operation. The subject of this technical bulletin is the Madison, Wisconsin, RDF-supplemental fuel project.

57239 **(PB—82-183708) Food prices and rising energy costs.** Lasley, F.A. (Economic Research Service, Washington, DC (USA). National Economics Div.). Feb 1982. 20p. (ERS—674). NTIS, PC A02/MF A01.

Food processors spent nearly 5 cents for fuel per each dollar of value added by manufacture in 1977--double the amount spent in 1972 and 1967. This study suggests that measuring energy costs as a percentage of the value added by production or manufacture and as a percentage of labor and management earnings may be better than the commonly used measurement of energy costs as a percentage of cash sales or expenses.

57240 **(UCB-NE—4022) Use of waste heat in district systems with considerations of seasonal-heat-demand variations.** Mahini, R.T.; Schrock, V.E. (California Univ., Berkeley (USA). Dept. of Nuclear Engineering). Jun 1982. Contract AT03-79ET15391. 116p. NTIS, PC A06/MF A01. Order Number DE82019923.

The use of waste heat in district heating systems and considerations of seasonal heat demand variations were studied. The system concept studied employed heat pumps stationed throughout an urban center to use the waste heat from a power plant condenser coolant (at a temperature of about 100°F) as their heat source and to deliver hot water (at about 150°F) in the consumer pipe line. The water from the power plant is circulated in a closed loop between the heat pump's evaporator and the power plant's condenser. The water in the distribution pipeline circulates in another closed loop between the heat pump's condenser and the consumer heat exchanger units. A model was developed to determine the size and operation schedule of the various components in the district heating system from which an optimum condition was concluded leading to the lowest cost and the maximum utilization of the waste heat from the power plant. The city of Philadelphia was used as the reference city for population density and climatic conditions. The cost of system was calculated under various circumstances. The parameters varied were the distance between the power plant and the heat pump stations, the temperature drop of the main line water in the heat pump's evaporator, the approach temperature of the heat exchanger in the district station, the annual heat load, and the monthly variations of the heat demand. The cost of the system was computed to be between 16 to 31 mills/kwhr depending on the operating condition.

57241 **Method and device for determining the position of a cutting tool relative to the rotational axis of a spindle-mounted workpiece.** Williams, R.R. (to Department of Energy). US Patent 4,320,580. 23 Mar 1982. Filed date 3 Sep 1980. vp.

PAT-APPL-183780.

The present invention is directed to a method and device for determining the location of a cutting tool with respect to the rotational axis of a spindle-mounted workpiece. A vacuum cup supporting a machinable sacrifical pin is secured to the workpiece at a location where the pin will project along and encompass the rotational axis of the workpiece. The pin is then machined into a cylinder. The position of the surface of the cutting tool contacting the machine cylinder is spaced from the rotational aixs of the workpiece a distance equal to the radius of the cylinder.

57242 **Rankine cycle augmented light-gas-flow turbine studies.** Minardi, J.E.; Lawson, M.O.; Salyer, I.O.; von Ohain, H.P.; Newman, R.K.; Boehman, L.I. (Univ of Dayton, Ohio). *Journal of Energy;* 5: No. 3, 142-145(May-Jun 1981).

An innovative low-power Rankine turbine concept is described which promises competitive efficiencies, low cost, significant reduction in rpm, low maintenance, and long-life operation over similarly rated turbines. The cycle uses a highly efficient two-fluid ejector which greatly lowers the turbine inlet pressure and temperature. The two-fluid ejector cycle is shown by theoretical studies to be capable of transferring energy at efficiencies in excess of 90% from a high-power flux fluid medium to a low-power flux fluid medium. The volume flow of the thermodynamic fluid can be augmented by as much as one hundred fold. For very low-power turbine applications (approx. 5 kW) this could result in far more favorable turbine sizes and rpm. One major application for this type turbine is the heating and cooling of houses with heat pumps. 4 refs.

57243 **(PB—82-158601) Analysis of the amount of energy and material used in the packing of liquid food and luxury food. Volume I: introduction, program and objectives of the project.** von Papen, S. (Rationalisierungs-Kuratorium der Deutschen Wirtschaft e.V., Eschborn (Germany, F.R.)). Feb 1981. Translation of Analyse des Energie-und Stoffeinsatzes zum Verpacken flussiger Nahrungs- und Genussmittel. Band 1: Einfuhrung- Aufgabenstellung und Zielsetzung des Projektes. 16p. NTIS, PC A02/MF A01.

Part 1 of this report includes the introduction, description of the program, and the objectives of the project. Program and objectives: Analysis of the amount of energy and materials used in the production of packagings from raw material up to packagings, ready for use, filling of the packagings and transport to the consumers, as well as alternatives to the disposal of waste and/or recycling. In addition, the opinion of consumers has been evaluated so as to improve the handling of packagings. Conclusions demonstrated that any other products can be examined for a more efficient use of material and energy, as well as the possibilities of recycling and/or waste disposal.

57244 **(PB—82-158635) Analysis of the amount of energy and material used in the packing of liquid food and luxury food. Volume 4: analysis of the possibilities for recovering packing wastes.** Buechner, J.; Geipel, W.; Hultzsch, R. (KA-Planungs G.m.b.H., Heidelberg (Germany, F.R.)). Feb 1981. Translation of Analyse des Energie-und Stoffeintsatzes zum Verpacken flussiger Nahrungs-und Genussmittel. Band 4: Analyse des Rueckgewinnungsmoeglichkeiten von Verpackungsabfaellen. 111p. NTIS, PC A06/MF A01.

The report includes: (a) Objectives: Analysis of the possibilities of recovering packing waste in the packaging industry, in the packaging and filling industry and on the consumer side. (b) Results: Concerning the packing waste, the technical process and the quantity and energy balance have been shown for recovering the raw material in order to recycle it into the manufacturing process, for reusing the original packings, for treating the waste in order to get the basic material for other products and for removal. Considering the locality of collection of waste, the possibilities of recovery have been shown and the energy required has been determined.

57245 **(PB—82-158643) Analysis of the amount of energy and material used in the packing of liquid food and luxury food. Volume 5: inquiry of consumer attitudes concerning packings and their potential recycling.** von Papen, S. (Rationalisierungs-Kuratorium der Deutschen Wirtschaft e.V., Eschborn (Germany, F.R.)). Feb 1981. Translation of Analyse des Energie-und Stoffeinsatzes zum Verpacken flussiger Nahrungs-und Genussmittel. Band 5: Das Verhaten des Verbrauchers gegenueber Verpackungen, dem Bedarf an Verpackungen und der moeglichen Recyclierung. 83p. NTIS, PC A05/MF A01.

This report includes: (a) Objective: To find out how far the consumer is ready to help insure that used packings are to be recycled. (b) Method: Independent inquiries were made. (c) Results: The opinion of the consumers can be seen as positive, and by more information and better disposition of collecting and sorting boxes, a lot can be done for recycling of packings by the consumers.

57246 **(PB—82-158619) Analysis of the amount of energy and material used in the packing of liquid food and luxury food. Volume 2: Material flow charts to determine energy useage from the raw material down to the filling of packings in the individual production steps.** Vogelsang, J.; Knoth, R. (Bonnenberg und Drescher Ingenieurgesellschaft m.b.H., Aldenhoven (Germany, F.R.)). Feb 1981. Translation of Analyse des Energie-und Stoffeinsatzes zum Verpacken flussieger Nahrungs- und Genussmittel. Band 2: Materialstammbaeume zur Erfassung des Energieeinsaetze vom Rohstoff bis zur Afbuellung des Verpackungen in den einzelnen Fertigungsschritten, n.p., 1981. 90p. NTIS, PC A05/MF A01.

The report deals with (a) objectives: Analytical examination of the amount of materials used in the production of packings, in packing process and filling of the packing in all producing steps. With (b) Result: Demonstration of the amount of materials in the production of packings from raw materials up to ready packings of multiple-way and one-way bottles, containers and kegs and also trays for beer and beverages. And (c) Conclusions: By the demonstrated methods any other product can be inquired as to the amount of material and energy input and output. The used methods allow to research the material input and output in large range of industrial products.

57247 **(PB—82-158627) Analysis of the amount of energy and material used in the packing of liquid food and luxury food. Volume 3: The summarized, specific energy consumption and possibilities to control it.** Flaschar, W.; Richter, G. (Forschungsstelle fuer Energiewirtschaft, Muenchen (Germany, F.R.)). Feb 1981. Translation of Analyse des Energie-und Stoffeinsatzes zum Verpacken flussiger Nahrungs-und Genussmittel. Band 3: Der kumulierte spezifische Energieverbrauch und die Moeglichkeiten zu seiner Beeinflussung, n.p., 1981. 105p. NTIS, PC A06/MF A01.

The objective of the project is to analytically examine the amount of energy used in production of packings in packing process. A demonstration shows the amount of energy and material in packings from raw material to filled packing of multiple-way and one-way bottles, containers and kegs, and also trays for beer and beverages.

57248 **(PB—82-158650) Analysis of the amount of energy and material used in the packing of liquid food and luxury food. Volume 6: analysis of specific energies for transportation of some packing materials.** Vogelsang, J.V. (Bonnenberg und Drescher Ingenieurgesellschaft m.b.H., Aldenhoven (Germany, F.R.)). Feb 1981. Translation of Analyse des Energie-und Stoffiensatzes zum Verpacken flussiger Nahrungs- und Genussmittel. Band 6: Ermittlung spezifischer Transportenergien ausgewaehlter Verpackungsmaterialien, n.p., 1981. 11p. NTIS, PC A02/MF A01.

This project deals with specific transport energies for glass bottles, cans for beverages, and paper bags for beverages.

57249 **(PB—82-156720) Energy saving in paper drying. Final report.** Lemaitre, A.; Videau, J.L.; Ramaz, A. (Commission of the European Communities, Luxembourg). 1981. Translation of Economie d'Energie Lors du Sechage du Papier, Grenoble, 25p, 1981. (EUR—7152-EN). 38p. NTIS, PC A03/MF A01.

A complete model of a multi-cylinder drier is presented, the main parameters of which are taken from measurements made on industrial plant. The utilization of this simulated model, based on operating conditions as defined above, enables research into optimum operation under fixed operating conditions to be carried out, especially as regards the extraction of air. The use of high frequency drying should make it possible to reduce profile variations across the width of the web. Its economic benefits ought to be reassessed at frequent intervals in relation to the price of oil and electricity respectively.

57250 **DOE-sponsored program on heat exchanger tube vibration.** Wambsganss, M.W.; Halle, H.; Chenoweth, J.M. (Argonne Natl Lab, Ill). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 595-599(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

An overview of the United States Department of Energy (US/DOE) sponsored Heat Exchanger Tube Vibration Program performed at Argonne National Laboratory is presented. The overall objective of the program is to contribute to the economically optimized design of industrial shell-and-tube heat exchangers capable of operating without damaging vibration. 9 refs.

57251 **Choosing the optimum bed material for a fluidized bed heat exchanger.** Williams, H.W.; Hernandez, R.; Mah, C.S. (Aerojet Energy Convers Co, Sacramento, Calif). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 600-605(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Shallow-bed fluidized bed, heat exchangers have been intensively studied for various applications and found to be competitive with conventional heat exchangers. Work has proceeded in studies for waste heat recovery, cooling system for heat pumps, dry cooling towers for power plants, and others. The Aerojet Energy Conversion Company (AECC) in a contract with the Department of Energy (DOE), is currently conducting a program to identify the ideal bed material for a given application. 10 refs.

57252 **Laboratory prototype fluidyne water pump.** West, C.D.; Pandey, R.B. (AERE, Harwell, Oxfs, Engl). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **2**: 1916-1918(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This paper describes a liquid-piston Stirling engine and water pump constructed during a research program to investigate the potential of these machines for small-scale irrigation pumping. 2 refs.

57253 **Application and experience with high temperature high performance ceramic recuperators.** Bjerklie, J.W.; Bond, B.A.; Penty, R.A.; York, W.A. (Hague Int, South Portland, Maine). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 606-611(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Application of recuperation to high temperature industrial furnaces to significantly reduce U.S. fuel consumption is discussed. Hague International's single pass, cross-flow, finned tube ceramic heat exchanger has been applied as a recuperator to various industrial fossil fuel fired furnaces. Operation up to 2600 F and fuel savings due to recuperation alone of approximately 40% are typical. 6 refs.

57254 **Opportunities for direct-contact waste heat recuperators for industrial heat recovery.** Richlen, S.L.; Semler, T.T. (Edgerton, Germeshausen and Grier Inc, Idaho Falls, Idaho). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 618-623(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A study to identify and assess the potential industrial applications of the direct-contact waste heat recuperator (DCWHR) for the 353 to 672 K temperature range has been completed. The DCWHR increases the heat transfer area per unit volume over typical heat exchangers, and is intended for latent heat recovery from waste streams. 16 refs.

57255 **Brayton cycle heat recovery for container-glass melting furnace.** Wei, G.C.; Williams, R.O.; Llewellyn, G.H. (Oak Ridge Natl Lab, Tenn). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 624-631(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A Brayton Cycle system of gas turbines to generate electrical power and of heat exchangers to provide secondary preheat to combustion air is shown to recover a significant amount of waste heat from the flue gas of a regenerative, container-glass melting furnace. Potential materials problems with the systems have been considered, and a program to evaluate these problems is in progress. 24 refs.

57256 **Ceramic heat pipes for high-temperature heat recovery.** Strump, H.J. (AiResearch Manuf Co, Torrance, Calif). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 632-637(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This paper summarizes the results of a conceptual design study for ceramic heat pipe recuperators conducted by the AiResearch Manufacturing Company, a division of the Garrett Corporation, for the University of California Los Alamos Scientific Laboratory. Potential fuel savings are in the 40- to 50-percent range. Calculated simple payback periods, based on potential fuel cost savings and estimated system costs, are less than six months for all designs, exclusive of specific retrofitting and high-temperature burner costs. 6 refs.

57257 **Comparison of working fluids used in ORC waste heat recovery systems.** Krazinski, J.L.; Buyco, E.H.; Bushby, H.M. (Argonne Natl Lab, Ill). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 1375-1381(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The performance and cost of Organic Rankine Cycle (ORC) heat recovery systems are examined. The properties of seven working fluids are compared and their impact on system design investigated. A computer code was developed for conducting the necessary analysis. 12 refs.

57258 **Unit process models for potential subsystems of energy-agro-waste complexes.** Diaz, L.F.; Glaub, J.C.; Golueke, C.G. (Cal Recovery Syst Inc, Richmond, Calif). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 481-486(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The mass and energy input and output streams of various agricultural, waste treatment, and energy production processes were quantified and models developed to serve in the engineering analysis of energy and waste utilization schemes. The unit process models can be integrated into energy-agro-waste complexes in which the wastes of various processes are used as inputs to others. 22 refs.

57259 **Energy characteristics of powered hand tools.** Talbott, E.M. (Varigas Res Inc). pp 270-283 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

A recommendation is made for considering energy efficiency as a significant lifetime cost element in the selection of powered rotary hand tool systems. The result should be increased demand for newer and more modern electric tools and discourages the tendency to overprescribe pneumatic tools.

57260 **Heat recovery and energy conservation in food processing.** Boykin, W.B. (Ga Inst of Technol). pp 370-382 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

This paper discusses the results of a Department of Energy sponsored project which demonstrated the application of energy conservation technology in poultry processing plants. The application of heat exchangers to recovery energy from process waste streams is discussed. Emphasis is given to the performance of heat recovery systems actually installed and which include a shell and tube exchanger recovering superheat energy from the plant refrigeration system.

57261 **Field testing of a 600 kW organic Rankine cycle waste recovery system: results to date.** Prasad, A. (Sundstraand Energy Syst). pp 482-494 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

The use of organic Rankine cycle engines to generate power from waste heat provides a near term means to greatly increase the fuel utilization efficiency of many processes. Sundstrand has developed a 600 KW ORC unit to recover energy from various waste heat sources. A field test program has been jointly funded by Sunstrand and the U.S. Department of Energy. As part of this program, five units are being placed in field to demonstrate the economic viability and the reliability of the equipment in commercial and industrial applications. This paper describes the system and the field test program.

57262 **(PB—82-160516) Study on an example of heat supply from waste heat.** Ebert, G.; Simoneit, H.W. (Wirtschaft und Infrastruktur G.m.b.H. und Co. Planungs-KG, Muenchen (Germany, F.R.)). Dec 1979. Translation of mono. Untersuchung Eines Modells der Waermeversorgung aus Absaerme, Munich, 173p, Dec 79. 128p. NTIS, PC A07/MF A01.

This study was prepared with the objective of presenting a guideline of the possibilities of waste heat utilization with the help of a specific problem. The first part deals with the general fundamentals of waste heat use. The topic is confined to the employment of smaller and medium waste heat sources with locations isolated from grid systems. These waste heat sources represent the major portion of the hitherto neglected waste heat potential. It is especially the isolated location which in many cases proved to be an obstacle to utilization. The subject of the study is only utilization without employment of heat pumps, because heat pumps as a rule require additional investment and operating costs. The second part deals with a specific problem. Using the example of the special refuse disposal facility in Ebenhausen, it is shown under what conditions a supply of waste heat from this waste heat source can be used economically for the heat supply of the community. On the basis of the supply and need situation in Ebenhausen, a technical design and economic analysis of a waste heat utilization model is presented.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 56040, 56091, 56187, 57088, 57125, 57135, 57189, 57191, 57232

57263 **(AD-A—108933/3) Actions by the Bonneville Power Administration to implement the long-term contracting provisions of P.L. 96-501.** (Vermont Univ., Burlington (USA). Dept. of Physics). 4 Sep 1981. 14p. (GAO/EMD—81-140). NTIS, PC A02/MF A01.

P.L. 96-501, which provides for regional electric power planning and development in the Pacific Northwest, emphasizes the use of conservation and renewable resources, preservation of the region's fish and wildlife, and protection of the environment. The Act requires the Bonneville Power Administration (BPA) to keep the cognizant congressional committees fully and currently informed of actions taken and to be taken by the Administrator under this Act. Based on limited review, it appears that BPA has latitude in how it could implement section 5(g)(1). The statute says that, within 9 months of the Act's effective date, BPA has to (1) begin necessary negotiations which would lead to initial long-term contracts and (2) make valid offers to its customers. Under section 5(g)(1), BPA had several options it could choose regarding offers and negotiations. BPA made the management decision to enter into negotiations for more than 8 months in an effort to draft contracts based on information obtained during the negotiating process. While the Act allows for negotiations for a period of 1 year after the offering of contracts, it appears that BPA management decided it would be better to complete as much of the negotiation phase as possible prior to offering the contracts.

57264 **(AD-A—111552/6) Greater energy efficiency can be achieved through land use management.** (Vermont Univ., Burlington (USA). Dept. of Physics). 21 Dec 1981. 59p. NTIS, PC A04/MF A01.

When planning new growth and redevelopment, communities can siginficantly reduce energy consumption by incorporating energy-efficient land use concepts such as site and building design, locational planning, and higher density development. Decisionmakers, however, are reluctant to use these concepts because of major barriers such as the cost of implementing the concepts and resistance to higher density development. The Federal Government can play a role in promoting energy-efficient land use by providing guidance through its policies, supporting research and comprehensive planning, and providing needed financial incentives.

57265 (BMFT-FB-T—80-157) **Preliminary investigation on a primary energy saving heat supply system for the residential district, Maria Lindenhofin Dorsten, West Germany. Final report.** Bechtel, A.; Berlinghoff, K.; Grossmann, H.; Kaschube, H.; Reinmuth, F. (KA-Planungs G.m.b.H., Heidelberg (Germany, F.R.)). Dec 1980. 126p. (In several languages). NTIS (US Sales Only), PC A06/MF A01.

Ways and means to operate a heating station by gas motor-driven heat pumps, using river water as heat source are investigated. The economic viability of the scheme is considered. A comparison with conventional technologies clearly shows the feasibility and effectiveness of this application, and at the same time supplies guidelines for design and dimensioning. Because of possible energy saving, the present investigation supports the realization of the project. (ESA)

57266 (DOE/CS/20468—T1-Vol.1) **Energy-Exchange Project.** (Starrett City Housing Corp., New York (USA); Starrett City, Brooklyn, NY (USA)). Apr 1982. Contract AC01-78CS20468. 60p. NTIS, PC A04/MF A01. Order Number DE82013988.

Portions of document are illegible.

The Starrett City/26th Ward Energy Project, a joint effort to develop the means to utilize waste-derived energy produced as by-products of municipal waste water treatment, is described. The project focused on developing and evaluating five energy transfer systems. These include: the transfer of digester gas produced at the 26th Ward to the boilers at Starrett City's total energy plant (TEP); the transfer of hot water heated at the TEP to the 26th Ward for space and process heating; the transfer of cool effluent waste water from the 26th Ward to the condenser cooling systems at the TEP; the transfer of sludge from the 26th Ward and equal amounts of municipal waste collected locally to a new sludge/solid wastes steam-producing facility to provide steam to the TEP; and the transfer of surplus electricity produced by the TEP to the 26th Ward. The systems were studied for technological, financial, institutional, and environmental feasibility. The study also examined the energy losses experienced in the Starrett City development, a complex of over 20,000 residents with its own schools, shopping and community centers, and power plant. It was concluded that the transfer of digester gas, hot water, and effluent between Starrett City's TEP and the 26th Ward proved the most feasible. Procedures for implementation of the project are explained and the construction program and costs are indicated. (MCW)

57267 (DOE/CS/20468—T1-Vol.2) **Energy-Exchange Project.** (Starrett City Housing Corp., New York (USA); Starrett City, Brooklyn, NY (USA)). Apr 1982. Contract AC01-78CS20468. 154p. NTIS, PC A08/MF A01. Order Number DE82013270.

Portions of document are illegible.

The purpose of the study was to determine what energy savings can be achieved by coordinating the resources and requirements of two facilities, the 26th Ward Water Pollution Control Plant (WPCP) and a housing development named Starrett City with its own total energy system. It was determined that three energy exchange options were economically and technically feasible. These include: the transfer of digester gas produced at the 26th Ward to the boilers at the Starrett City's total energy plant (TEP); the transfer of hot water heated at the TEP to the 26th Ward for space and process heating; and the transfer of coal effluent waste water from the 26th Ward to the condenser cooling systems at the TEP. Technical information is presented to support the findings. The report addresses those tasks of the statement of work dedicated to data acquisition, analysis, and energy conservation strategies internal to the Starrett City TEP and the community it supplies as well as to the 26th Ward WPCP. (MCW)

57268 (MASEC-CF—81-096, pp 108-127) **Method for analyzing the value and avoided costs associated with dispersed technologies.** Davitian, H. (Entek Research, Inc., East Setauket, NY). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

A method (used by Entek Research, Inc.) by which an electric utility may carry out a value and marginal cost analysis when dispersed generating technologies (such as cogeneration, solar, wind, etc.) are interconnected to the utility system is discussed. An outline of the approach is given, and applications and examples of results are included. The potential for dispersed technologies is estimated to the year 2000 and generation requirements based on 2%/year and 4%/year growth rates are used. Rates (influenced by avoided cost purchase and analysis of costs of backup), value analyses, load analyses, resource planning, and environmental impacts are discussed as factors. Detailed schematics of the method (based on computer algorithms) are given and discussed. The application of this analytical approach to four electric utility systems to study 6 different dispersed technologies and their load modifying effects are discussed briefly. It is concluded that the method proposed is a flexible and powerful analytical tool. (MJJ)

57269 (MASEC-CF—81-096, pp 238-245) **Viewpoint from the consumer perspective.** Peterson, K. (Minnesota Public Interest Research Group, Minneapolis). 1981. NTIS, PC A18/MF A01.

From Utility planning - impact of alternate energies - consumer's side of the meter conference; Bloomington, MN, USA (27 Apr 1981).

Representing the Minnesota Public Interest Research Group (a student funded organization) the following views are expressed: (1) utilities are in trouble because they are planning on large centralized plants; (2) there should be more emphasis on energy conservation by the utilities; (3) small generating stations and district heating should be encouraged; (4) alternate energy source development should be encouraged; (5) utilities tend to support the big and dramatic (power towers, solar satellite, etc.) when they should be encouraging small generation plants and buying back power from their customers; (6) solar applications should be encouraged; and (7) it appears that utilities are headed for financial problems. (MJJ)

57270 (NP—2750479) **District heating distribution network. Long-distance transport. Uniform prices. Installations in areas off road foundations. Extra charges for crossroads.** (Elkraft, Ballerup (Denmark)). Nov 1981. 31p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750479.

Portions of document are illegible.

There have been introduced uniform charges to be used in investment estimates and bidding for heat-transmission pipeline systems transporting water from central heating plants along the roads but off their foundations. Extra charges for pipe installations over the road areas, crossroads and watercourse, are given. Prices are estimated as charges per meter (2 preinsulated tubes) for single tube diameters. Installation rate is presumed to be 300 m daily with known technology and equipment.

57271 (NP—2750481) **Standard uniform prices to use in planning of district heating distribution network.** (Elkraft, Ballerup (Denmark)). Sep 1980. 49p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750481.

The objective of this report is to propose uniform prices for all the links in district heating distribution systems. These costs and prices include materials of accepted quality, welding and plumbing of tubes, pipe joints, insulation of pipe assemblies, drainage of ground water, wells and repair chambers. Prices have only guidline character and do not include to state sale tax, which is approximately 21% in 1982. A reservation has to be made for differing contractor costs over Denmark.

57272 (NP—2901408) **Tacoma refuse fired combustor study for the City of Tacoma, Washington.** (Durham, Anderson, Freed/HDR, Seattle, WA (USA)). Mar 1978. 242p. NTIS, PC A11/MF A01. Order Number DE82901408.

Portions of document are illegible.

The study examines the feasibility of using refuse-derived fuels and other municipal wastes to fire a central energy plant to meet the heating and cooling needs of Tacoma, Washington, with the possibility of marketing steam and/or electricity as a by-product. A description of the present central heating system is described and the present and future markets of energy in the central business district and the adjacent industrial area are discussed. Technical aspects of the combustor systems and energy distribution systems are reported. Three possible locations for a central energy plant are identified and descriptions of the sites are given. The availability of waste fuels, focusing on hog fuel and refuse-derived fuels, is discussed. The potential environmental impacts on air, water, and land are reviewed. A technical description of the ten alternative central energy plant designs, their associated distribution systems, and an economic analysis of each are detailed. The financing alternatives, ownership and operation alternatives, and implementation alternatives for a new central energy plant are discussed. Possible methods of energy facility ownership, with details of necessary agreements applicable for municipal participation, are reviewed. (MCW)

57273 (PB—82-175308) Cogeneration/total energy case studies. Friedman, N.R.; Zabek, E.; Wakefield, R.A. (Mathematica, Inc., Princeton, NJ (USA). Mathtech Div.). Dec 1980. 91p. NTIS, PC A05/MF A01.

These total energy case studies were prepared for HUD as part of the Modular Integrated Utility Systems (MIUS) Program. MIUS, in its simplest form, is an extension of the concept of total energy / cogeneration, which provides onsite electrical power to small commercial, residential / commercial, and industrial users and furnishes other utility services such as space heating, hot water, and process steam from the waste heat recovered from prime movers. This study prepares cost studies of total energy systems (TES) as a basis to develop information on the operation of successful cogeneration sites by analyzing six TES's operating in Kansas, Connecticut, New Jersey, Ohio, and New York. Information on each site consists of individual narrative summaries, fact sheets, and schematic drawings. Criteria for selecting the specific systems were demonstration of economic viability and availability of data performance. The six sites are representative of the technologies and performance achieved by such plants in the late 1960's and early 1970's. As a result of these case studies, the following issues have emerged as most significant to the success or failure of total energy plants: grid connection, rate setting and economics, maintenance practices, and reserve margin. The report concludes that the role TES will play in meeting future energy needs will be largely determined by their future peformance using new and improved generating technologies, the degree to which they depend upon scarce fuels, and the future regulatory climate for cogeneration systems and small power producers. Schematics, footnotes, and an appendix presenting an inventory of cogeneration and total energy systems are provided.

57274 (PB—82-175316) Operator's report on the Summit Plaza total energy plant in Jersey City, New Jersey. Orlando, J.A.; Korobkin, L.R.; Pettit, V.E.; Caloger, S. (Gamze-Korobkin-Caloger, Inc., Chicago, IL (USA)). 17 Mar 1981. 88p. NTIS, PC A05/MF A01.

This report describes the design and operation of a HUD - sponsored demonstration program to provide a residential / commercial complex in Jersey City, N.J., with a Total Energy (TE) system. The system involves a single facility which uses a source fuel to provide both electrical and thermal energy in sequence. The TE concept is intended to provide many benefits, including decreased source energy use, decreased life cycle utility costs, and reduced adverse environmental impacts. HUD sponsored the design, construction, and operation of the TE plant at the Summit Plaza Operation Breakthrough site in order to develop comprehensive and credible information to aid future decisionmaking on utility site planning. The actual TE plant operation began in December 1973. The major plant components were an engine - generator, boilers, a chiller, a control system, a cooling tower, and dry coolers. A pneumatic trash collection system was added to the original design. The report addresses the issues of maintenance procedures and schedules, plant staffing, equipment reliability, data collection, operating and maintenance costs, and facility management. Among major recommendations are that plant personnel perform most scheduled and unscheduled maintenance activities to minimize the use of contractor personnel and that a set of controls be implemented to ensure acceptable routine maintenance. Findings also showed that scheduled engine generator maintenance procedures could be significantly deferred with no apparent loss of equipment reliability and that the plant requires one full - time operator and a part - time assistant. Designers must make the tradeoffs required by the diverse and competing interests involved in such a facility. Tables, graphs, diagrams, and eight references are supplied. (Author abstract modified).

57275 District heating for the state of Minnesota. Sundberg, R.E. (State of Minn Energy Agency). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 516-521(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The Minnesota Energy Agency is actively involved in implementing new hot water cogeneration district heating systems in Moorhead (POP 34,000), Red Wing (POP 13000), and St. Paul (POP 310,000). These projects have been funded by the Department of Energy, the State and the cities. The district heating systems designed will use coal and cogenerated thermal energy from existing electric generation plants. 8 refs.

57276 Coal's future with PG and E: actions taken, options available, problems foreseen. Osmond, J.C. pp 111-120 of Coal production and transportation: sixth annual conference, 1980. San Francisco, CA; PLM, Inc. (1980).

From 6. annual coal production and transportation conference; San Francisco, CA, USA (2 Apr 1980).

In our published plans to use coal between now and 1990, we are intending to participate, or we are considering participation, in the Warner Valley/Harry Allen project in Utah and Nevada. We are planning to build Montezuma I and II - these are direct-fired coal plants; we are considering possible sites for Fossil 3 and 4 direct-fired coal plants as well; and we have in the future some plants as yet unspecified. Montezuma I has slipped from 1986 to 1988 and Montezuma II from 1987 to 1989 within the last two weeks [and subsequently to 1989 to 1990]. We have also in our plans Fossil 3 and 4, which are proposed as 800 megawatt direct-fired units at one site, and we are in the process of evaluating several sites prior to submission of a notice of intention and beginning the first of two 18-month approval procedures before the Energy Commission. At least three sites must be nominated if the plants are to be built in California. The fuel for these units is undecided upon, and will depend in part on the locations. Certainly, access to rail or ship transport are among the factors that will be considered. We are also interested in possibly participating in the Coolwater project of Southern California Edison and Texaco, a very small demonstration near Barstow. The project will demonstrate the conversion of coal into gas and the use of the gas to generate electricity. This has a popular appeal with the Energy Commission because it involves the creation of a clean fuel. Also, in the next ten years we hope to be involved in the use of coal in one or more cogeneration projects, and in one or more projects for the conversion of coal to synthetic natural gas or medium Btu gas, or other synthetic fuels for electrical generation.

57277 Two applications for heat pump centered integrated community energy systems (HP-ICES). Crane, R.E.; Lorsch, H.G.; Werden, R.G. (Franklin Res Cent, Philadelphia, Pa). pp 522-534 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

An integrated community energy system is described based on present-day heat pump technology (HP-ICES) which provides the heating and cooling requirements of a community by means of a common piping loop to which all buildings are connected. Each building has a water-source heat pump which heats or cools as required and extracts heat from, or rejects heat to, the common piping loop. While the HP-ICES concept described in this paper is based on a diesel-powered central plant, it is equally applicable to a central plant powered by prime movers fueled with less scarce energy sources, e.g., coal-fired steam turbines. 8 refs.

57278 **Policy simulation for boom towns.** Ford, A. (Los Alamos Sci Lab, NM). *Simulation Councils Proceedings Series;* 8: No. 1, 87-94(Jun 1978).

This report summarizes the progress that several groups have made in developing models to aid in decision-making for energy boom towns. The report concludes with a discussion of the use of multiattribute value models to gauge the reaction of individuals to the outcomes generated by the BOOM1 simulation model.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 57132, 57202

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 57214

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 56428, 57295, 57295, 57297

57279 **(AD-A—109023/2) Performance of industrial-type engines in military equipment using synthetic crankcase oils. Final report.** Austin, G.H.; Bowen, T.; Cheek, L.; Zanedis, B. (Army Mobility Equipment Research and Development Center, Fort Belvoir, VA (USA)). Jun 1981. 187p. (MERADCOM—2326). NTIS, PC A09/MF A01.

The investigation was to determine the possibility of eliminating crankcase oil changes in engines used in military equipment. Based on the results, it appears that an extended oil change interval can be used which would result in significant savings.

57280 **(AD-A—110614/5) Effect on fuel efficiency of parameter variations in the cost function for multivariable control of a turbofan engine. Master's thesis.** Dougherty, B.L. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1981. 106p. NTIS, PC A06/MF A01.

Thesis.

In modern turbofan engines, variable geometry has been incorporated to improve some off-design performance. Most control designs ignore this variable geometry and use fuel metering as the primary control input. This thesis investigates the use of variable geometry to control the engine and, thereby, reduce fuel consumption due to transients. Additionally, steady-state trim conditions are altered to reduce the static fuel consumption. The non-linear transient simualtion program is used to analyze the steady-state operating condition and develop small perturbation control limitations. Linear models, both large and reduced order, are used in analyzing the effect of controllers on system response. A computer program was generated to reduce a large order linear model to a usable size for control system development. This analysis shows the reduced-order regime dependent controllers to be viable and to favorably enhance the quest for reducing specific fuel consumption in existing engines.

57281 **(PB—82-164088) Closed loop control of automotive engines. Final report Feb 1978-Jun 1980.** Powell, J.D.; Glaser, I.; Randall, K.; Hosey, R. (Stanford Univ., CA (USA). Guidance and Control Lab.). Dec 1981. 316p. NTIS, PC A14/MF A01.

Internal combustion engine economy and emissions are known to be sensitive to changes in engine control variables. Two of the most important variables are fuel/air ratio (F/A) and spark advance. These variables are affected by environmental changes, manufacturing tolerances, and time degradation. The combined effect of all these changes can cause as much as a 15% loss in economy and a 30% increase in emissions. This research concerns the application of optimization theory to develop control laws for use in closed loop control strategies to minimize the effect of the variables discussed above. The report describes the automated dynamometer facility developed for the acquisition of engine mapping data. This data was used to develop analytical functions describing the fuel consumption and emissions at each of 10 torque/RPM points. The functions were used by an optimization procedure to arrive at control strategies and driving cycle predictions of fuel consumption and emissions. The optimum schedules were then used to determine a closed-loop control strategy.

57282 **(PB—82-168949) Evaluation of the Greer fuel preheater under Section 511 of the Motor Vehicle Information and Cost Savings Act. Technical report.** Barth, E.A. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1981. 56p. (EPA-AA-TEB—511-81-2). NTIS, PC A04/MF A01.

This document announces the conclusions of the EPA evaluation of the 'Greer Fuel Pre-Heater' device under provisions of section 511 of the Motor Vehicle Information and Cost Savings Act. On January 20, 1981, the EPA received a request from Michael M. Greer for evaluation of a fuel saving device termed the Greer Pre-Heater. This device is claimed to make an automobile use a greater percentage of the energy injected into the carburetor and increase the miles per gallon without affecting pollution factors by preheating the gasoline before it reaches the carburetor. The device operates as a tube and shell heat exchanger. It uses the engine coolant as the heat source and transfers this heat to the gasoline by conduction.

57283 **(PB—82-176801) Scope for increasing the efficiency of automotive engines through combustion research.** Thomas, A. (Cambridge Univ. (UK). Dept. of Engineering). 1979. 42p. NTIS, PC A03/MF A01.

This report describes the evolution of a program of research in combustion, the broad objective of which was to assist in effecting improvements in the thermal efficiency of automotive engines without undue penalties in other aspects of performance, and at an acceptable cost. The gasoline engine receives first priority, and an extensive review of possible routes for improvement narrowed the field to attempting to increase compression ratios in conjunction with the use of leaner mixtures. The barrier to such developments was the slowness of combustion of lean mixtures. The time of combustion is shown theoretically to depend principally on a flame-stretching factor, which in turn is shown to depend on velocity gradients in the unburnt gas. This treatment of engine combustion is significantly different from the way in which other investigators are approaching the matter.

57284 **Coal derived (SRC II) fuel in a medium speed diesel engine: an investigation.** Hoffman, J.G. Jr. (GE, Erie, PA). *American Society of Mechanical Engineers,* [*Paper*]; No. 82-DGP-17, vp(Mar 1982).

One of the potential liquid fuels derived form coal is known as SRC II. The "middle distillate" product has a distillation range and viscosity characteristics much like No. 2 diesel fuel. Fuel consumption, exhaust emissions and part temperatures were obtained by operation in a 2-cylinder engine while directional wear effects were determined from 200 hr of operation in an 8-cylinder engine. Results of both 2-cylinder and 8-cylinder engine operation are presented. 8 refs.

57285 **Federal program in advanced automotive engines.** Brogan, J.J. (US DOE). pp 556-563 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

The present paper describes the federal program to develop alternative automotive engines which aim to achieve optimum fuel economy and pollution objectives.

57286 **Alternate fuel options for diesels and gas turbines.** Cart, E.N. Jr. (Exxon Res & Eng Co). pp 702-711 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

Diesel engines and gas turbines are widely used in transportation and industrial applications. From an efficiency standpoint the diesel engine is favored among the time proven engines. In addition to having a high thermal efficiency at full load, it maintains its efficiency at part load. The purpose of this paper is to point out the importance of these two types of prime movers, what alternate fuels could be considered as replacements for petroleum and natural gas with these engines, to provide some basic factors on these alternate fuel options and to discuss the interactions between fuel properties and the diesel and gas turbine engines. 4 refs.

57287 **(PB—82-162082) Analysis of the part-load operation of controlled ignition engines. Definition of the optimum courses of action with regard to energy output. Final report.** Douaud, A.; Eyzat, P. (Commission of the European Communities, Luxembourg). [nd]. 131p. (In French). (EUR—7190-FR). NTIS PCE06/MF E06.

The influence of the parameters concerning engine control and design was studied in turn for a single-cylinder experimental engine and for a mass produced multi-cylinder engine. The results of bench tests were interpreted and supported by mathematical models describing the phenomena occurring within the cylinder, viz. combustion, heat exchange and mass transfer. A significant body of data was obtained which led to a better understanding of the behavior of engines under specified conditions. (Copyright (c) CECA-CEE-CEEA, Bruxelles-Luxembourg.)

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 57285, 57285

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 57038, 57041, 57042, 57048

57288 **(AD-A—111093/1) Electric vehicle power controller. Master's thesis.** Frazier, J.C. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1981. 116p. (AFIT/GAE/AA—81D-1). NTIS, PC A06/MF A01.

The design of a general purpose microcomputer-based control system for an electric vehicle drive unit is described. This is a research and development system designed with an active operator interface for evaluating performance, dynamic control, parameter modification, and test program interaction. A microcomputer controller processes speed commands and monitors battery energy consumption during the driving cycle. This design effort demonstrated that a unique one-of-a-kind microcomputer controller is easy to construct and interface with the vehicle's systems.

57289 **(DOE/CS/54209—5) Upgrading demonstration vehicle task report.** Bryant, J.; Hardy, K.; Livingston, R.; Sandberg, J. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Oct 1981. Contract AI01-78CS54209. 157p. NTIS, PC A08/MF A01. Order Number DE82005810.

Portions of document are illegible.

The Upgraded Demonstration Vehicles Task investigated vehicle/battery performance capabilities and interface problems that occurred when upgraded developmental batteries were integrated with upgraded versions of commercially available electric vehicles. Vehicles used in the testing programs were the Jet Industries Electra Van 600, the Electric Vehicle Associates Change-of-Pace Wagon, the Battronic Truck Corporation Volta Pickup, and the South Coast Technology R-1 Electric. Developmental batteries used included nickel-zinc batteries from Energy Research Corp. and Yardney Electric Corp., a nickel-iron battery from Westinghouse Electric Corp., and an improved lead-acid battery from Globe-Union, Inc. Testing of the electric vehicles and upgraded batteries was performed in the complete vehicle system environment to characterize performance and identify problems unique to the vehicle/battery system. Constant speed tests and SAE J227a driving schedule range tests were performed on a chassis dynamometer. The results from these tests of the upgraded batteries and vehicles were compared to performance capabilities for the same vehicles equipped with standard batteries. Conclusions from the upgrade testing were that the developmental maturity of the vehicles and batteries was insufficient to merit deploying up to 200 upgraded vehicles for a technology demonstration program. A recommendation was made to defer the demonstration and extend the research activities.

57290 **(EUR—7072-DE) Galvanic high energy cells with molten electrolytes.** Borger, W.; Kappus, W.; Kunze, D.; Laig-Hoerstebrock, H.; Panesar, H.; Sterr, G. (Commission of the European Communities, Luxembourg). 1981. 227p. Commission of the European Communities, Luxembourg.

To develop a galvanic cell with molten salt electrolyte for electric vehicle propulsion and load leveling as well as to fabricate ten prototype cells with a capacity of at least 150 Ah (5 hour rate) and an energy density of 80 Wh/kg was the objective of this project.

57291 **(PB—82-169533) Propulsion alternatives for suburban rail corridors. Final report.** Ablamsky, R.A.; King, C.M. (Tri-State Regional Planning Commission, New York (USA)). Sep 1981. 137p. NTIS, PC A07/MF A01.

This study examined 5 propulsion alternatives to extending existing capital-intensive electrification and using additional electric multiple-unit (MU) cars. The objectives of this study were: (1) to identify alternatives to existing electric MU cars and diesel locomotive hauled trains used for commuter rail service in the New York-New Jersey-Connecticut region, (2) to evaluate each alternative in terms of performance capability, reliability, and other technical factors or constraints, (3) to develop capital and operating cost data for each alternative and type of electrification, and (4) to compare each baseline electrification system with feasible propulsion alternatives. The following propulsion alternatives were compared: dual-powered locomotive, alternating current locomotive, direct current locomotive, and dual-powered MU car.

57292 **View of the future potential of electric and hybrid vehicles.** Kirk, R.S.; Davis, P.W. (DOE). pp 581-608 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

A summary of the Department of Energy (DOE) projections for the future for electric and hybrid vehicles (EHVs) is presented. This outlook is based upon a review of the history of EHVs in the U.S., the development of Government interest leading to the current DOE EHV program, and four years of implementation of the DOE program in partnership with industry. Recent focus of the program toward specific future commercialization objectives is testimony to judgments on the future potential for electric and hybid vehicles in the U.S. transportation system. 26 refs.

57293 **Energy storage for transportation.** Mayo, J.W.; Lendgrebe, A.R.; Klunder, K.W.; Nelson, P.; Cooper, J.; Srinivasan, S.; McBreen, J.; McCormick, B. (US DOE). pp 627-640 of Energy technology 7, expanding supplies and conservation: proceedings of the energy technology conference, 7th, 1980. Volume 1. Hill, R.F. (ed.). Washington, DC; Government Institute Inc. (1980).

From 7. energy technology conference and exposition; Washington, DC, USA (24 Mar 1980).

The Energy Storage program of the U.S. Department of Energy proposes the development of secondary storage batteries, mechanically rechargeable batteries, hydrogen storage, flywheels and fuel cells for automotive propulsion applications. The successful development of energy storage for this purpose proposes significant savings of oil rsources and beneficial environmental effects. 3 refs.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 57292

3305 Flywheel Propulsion

57294 (PB—82-156795) Computer simulations and literature survey of continuously variable transmissions for use in buses. Final report, June-December 1981. Barrows, T. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Dec 1981. 50p. (DOT-TSC-UMTA—81-54). NTIS, PC A03/MF A01.

Numerous studies have been conducted on the concept of flywheel energy storage for buses. Flywheel systems require a continuously variable transmission (CVT) of some type to transmit power between the flywheel and the drive wheels. However, a CVT can provide some fuel economy benefit with or without an energy-storing flywheel, which is the focus of this report. This computer study and literature review is intended to provide insight into the potential applicability of CVTs to buses. It has been suggested that such transmissions may be of interest for two reasons: (1) simple substitution of a CVT in the place of a conventional transmission may offer fuel savings by allowing the engine to operate at its most efficient speed and (2) the combination of a CVT and a flywheel allows regenerative braking, in which the vehicle kinetic energy during deceleration is captured for later re-use. This computer study and literature survey considers several examples of CVTs in buses, both with and without flywheel energy storage, and finds a predicted energy savings of 10 to 32 percent. The analysis focuses on the use of a CVT alone, without regenerative braking. Computer simulations are made to compute the fuel use of a bus with two different CVTs - one with a ratio range of 6, and the other of an infinite ratio range. For the former, assuming an efficiency of 85 percent, a fuel savings of 12 to 22 percent is predicted, depending upon the driving cycle. It is shown that a substantial part of this saving arises from the simple fact that the accessories operate at a lower speed. For this reason, a separate study of accessory speed control has been conducted, yielding a predicted fuel saving of as high as 17 percent. The report concludes that such accessory speed control may represent an attractive way to reduce fuel consumption. In comparison with the CVT, the concept is more compatible with present bus technology.

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 57294

3307 Emission Control

REFER ALSO TO CITATION(S) 56180, 57297, 58112

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 56175, 56178, 56206, 56460, 57284

57295 (AD-A—111103/8) Potential for energy cost reductions in 'Hamilton Class' cutters through fuel modification. Final report. Plank, G.; Weidner, F. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Sep 1981. 46p. (TSC-USCG—81-3). NTIS, PC A03/MF A01.

A review of all pertinent and available literature on the use of blended fuel and water-in-fuel emulsions in marine power plants was accomplished with special attention paid to the use of this technique with gas turbines. Telephone contact was made with the engineering officers on all of the available (in-port) 'Hamilton Class' cutters and 'Polar Class' icebreakers to determine the operating schedules of the gas turbines on these vessels as well as fuel consumption and maintenance history. The opinions of the engineering officers were solicited with respect to any special problems which may exist, either with the hardware or operations of the vessels that would act to prevent or impede the use of a water-in-fuel emulsion. A cost/benefit analysis was performed for the case of a blended fuel for the diesels and a water-in-blended fuel emulsion for the gas turbines.

57296 (DOE/PE/70045—T3) Assessment of current and projected future trends in light-duty-vehicle fuel switching. Subtask 1 report. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jun 1982. Contract AC01-78PE70045. 49p. NTIS, PC A03/MF A01. Order Number DE82018816.

Trends in fuel switching by motorists during the period 1978 through 1981 were assessed with the use of two data bases of monthly household purchases of gasoline. Fuel switching was defined as either misfueling - the use of leaded gasoline in cars that require unleaded fuel - or discretionary switching - the use of unleaded gasoline in cars which can operate on leaded fuel. To identify disaggregated patterns of fuel switching, the data were stratified by year, season, census region, type of service station outlet, vehicle category and vintage. In addition, the relationship of trends in misfueling rates to changes in the relative prices of unleaded and leaded gasoline also was examined. Drawing upon the analysis of current data, three alternative future trends in misfueling rates by vehicle vintage were constructed. The impact of each of these cases on projections of the market share of leaded gasoline was examined with the aid of a previously developed model of highway fuel demand.

57297 (PB—82-154113) Emission characterization of an alcohol/diesel-pilot fueled compression-ignition engine and its heavy-duty diesel counterpart. Final report, August 1980-August 1981. Ullman, T.L.; Hare, C.T. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1981. 239p. NTIS, PC A11/MF A01.

This report describes results from emissions testing of a prototype diesel engine, developed by Volvo Truck Corporation of Sweden, which uses pilot injection of diesel fuel for compression ignition of alcohol fuel injection for main combustion. In addition to this dual-fuel engine, emission testing was also conducted on a heavy-duty diesel engine of similar design. Both engines were tested over the 1979 13-mode FTP, or shorter versions of this modal test, and over the 1984 Transient FTP as well as an experimental bus cycle. The dual-fuel engine was characterized with methanol, ethanol and ethanol with 30 percent water (wt %). An oxidation catalyst was also used with methanol and ethanol. Emission characterization included regulated emissions (HC, CO, and NOX) along with total particulate, unburned alcohols, individual hydrocarbons, aldehydes, phenols, and odor. The particulate matter was characterized in terms of particle size distribution, sulfate content, C, H, S, metal content, and soluble organic fraction. The soluble organic fraction was studied by determining its elemental composition (C,H,S,N), boiling point distribution, BaP content, relative make-up of polar compounds, and bioactivity by Ames testing.

57298 Cost parity between hydrogen and petroleum transportation fuels (f.o.b. plant). Tison, R.R. (Escher: Foster Technol Assoc Inc, St. Johns, Mich). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 1454-1458(1981). (CONF-810812—).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Hydrogen production costs for electrolytic, thermochemical, and coal-based processes are accumulated from the literature, normalized, and compared with petroleum-derived transportation fuel costs as a function of average refiners' crude costs. 31 refs.

36 MATERIALS

57299 (INIS-mf—7059-Vol.2) Proceedings of the international conference on amorphous systems investigated by nuclear methods. Kajcsos, Z.; Dezsi, I.; Horvath, D.; Kemeny, T.; Marczis, L.; Nagy, D.L. (eds.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Magyar Tudomanyos Akademia, Budapest; Eoetvoes Lorand Fizikai Tarsulat, Budapest (Hungary)). 1981. 523p. (CONF-8108121—Vol.2). NTIS (US Sales Only), PC A22/MF A01. Order Number DE82780695.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

A separate abstract was prepared for each paper presented. (HDR)

57300 (INIS-mf—7095) Fundamentals, fabrication, and properties of powder metallurgical materials. Part 1. Review papers, poster summaries. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. 180p. (In several languages). (CONF-8109158—Pt.1-Summ.). NTIS (US Sales Only), PC A09/MF A01. Order Number DE82780702.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

Individual items in scope for the data base are entered separately. (DLC)

57301 (INIS-mf—7096) Fundamentals, fabrication, and properties of powder metallurgical materials. Part 2. Summaries. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. 294p. (In several languages). (CONF-8109158—Pt.2-Summ.). NTIS (US Sales Only), PC A13/MF A01. Order Number DE82780701.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

Individual items in scope for the data base are processed separately. (DLC)

57302 (INIS-mf—7097) Fundamentals, fabrication, and properties of powder metallurgical materials. Part 3. Summaries. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. 350p. (In several languages). (CONF-8109158—Pt.3-Summ.). NTIS (US Sales Only), PC A15/MF A01. Order Number DE82780703.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

Individual items in scope for the data base are entered separately. (DLC)

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 56010, 56103, 56259, 56259, 56260, 56430, 56440, 56573, 56657, 56658, 56659, 56660, 56661, 56710, 56755, 56759, 56761, 56763, 56764, 56784, 56792, 56797, 56802, 56817, 56818, 56819, 56820, 56821, 56822, 56824, 56846, 56847, 56858, 56862, 56863, 56864, 56865, 56903, 56903, 56924, 56925, 56927, 56930, 56932, 56932, 56933, 56934, 56935, 56936, 56941, 56976, 56985, 57241, 57608, 57763, 57764, 58674, 58766, 58963, 58963

57303 (AD-A—108982/0) Electronically induced phase transformations. Interim scientific report 1 Oct 80-30 Sep 81. Freeman, A.J. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy). 30 Nov 1981. 11p. NTIS, PC A02/MF A01.

The electronic interactions responsible for the observed electronically induced phase transformations in several important classes of materials were investigated theoretically in close collaboration with experimental programs at other institutions. These include the high field superconductivity of Chevrel phase compounds and the first theoretical demonstration that the Jaccarino-Peter mechanism is responsible for the large increase in the upper critical field when large concentrations of Eu magnetic impurities are added to SnMo6S8, an extensive study of the unusual magnetic and superconducting properties of some C15 compounds, self-consistent energy band calculations including all electrons and all atoms in the 16 atoms per unit cell of the linear chain transition metal trichalcogenide, TaSe3, and the first demonstration of the onset of a metamagnetic transition in Pd Metal.

57304 (AD-A—110133/6) Superconductivity in hydrogen-charged copper-implanted palladium. Final report. Leiberich, A.; Scholz, W.; Standish, W.J.; Homan, C.G. (Army Armament Research and Development Command, Watervliet, NY (USA). Large Caliber Weapon Systems Lab.). Dec 1981. 18p. (ARLCB-TR—81045). NTIS, PC A02/MF A01.

A superconducting transition temperature, T sub c of 124 K has been observed in palladium implanted with copper ions and electrolytically charged with hydrogen at dry ice temperature. A step-wise warmup procedure between 77 K and 273 K produces considerable variations in T sub c. Annealing the copper implanted palladium before electrolysis does not change T sub c to a substantial degree.

57305 (AD-A—110979/2) Ultrafine-grained superconductors. Annual report 1 January-31 December 1981. Ashkin, M.; Braginski, A.I.; Gavaler, J.R. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 4 Jan 1982. 19p. NTIS, PC A02/MF A01.

Measurements of the effect of strain on the critical current of NbN show that almost no degradation occurs even at the highest strain levels, 0.5%, and the highest fields, 22T, that could be applied. Data at 4.2K in pulsed fields of over 30T suggest that the enhanced critical field measured in ultrafine-grained NbN films are due to a dimensional effect. Data on laser annealed Nb-Ge films further elucidated the role of second-phase pinning in enhancing the critical currents in these films. Electron beam annealing did not enhance significantly the critical current density. Pseudobinary V-Si-C alloys with critical temperatures of 17K were prepared by C-implantation of vanadium-rich V-Si films and subsequent annealing. A theory of current distribution near the end of a filamentary conductor and the effect on ac losses was developed. Some features of the anomalous SAW attenuation measured in NbN films were explained using the Kosterlitz-Thouless theory.

57306 (AD-A—110990/9) Design and validation of an apparatus for high temperature fatigue testing in an inert environment. Master's thesis. Hastie, W.A. Jr. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1981. 58p. NTIS, PC A04/MF A01.

A synergistic interaction between creep and fatigue in structural materials at high temperature has previously been shown to exist. More recently, the importance of environmental effects on fatigue has been shown to frequently over-shadow the creep-fatigue interaction. As both creep and environmental effects are temperature and time dependent, the role of each is often difficult to separate. The topic of this thesis is the design and validation of an apparatus to study the interactions of environment and creep with fatigue damage at high temperature. The alloy (2 + 1/4) Cr - 1 Mo steel was selected for testing to validate the system as considerable creep-fatigue data exist on this alloy. Strain controlled fully reversed testing was conducted at temperatures of 482 C (900 F) and 538 C (1000 F). The results of the testing at 1% total strain range agreed with published data from the same heat of material. Differences in results at 0.5% total strain range were, however, found to exist. The differences are believed to be due to different specimen geometries used by other studies. This research used uniform gage length instead of the standard hourglass specimens used by others. The uniform gage length samples have a lower fatigue life at the lower strain range than published data. The results from uniform gage length samples are believed to be a better representation of a materials bulk fatigue behavior.

57307 (AD-A—110992/5) Studies of the low temperature hot corrosion of uncoated superalloys. Newberry, G.D. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1981. 45p. NTIS, PC A03/MF A01.

Thesis.

Several nickel-based superalloys used in the manufacture of gas turbine hot section components were investigated to determine potential alloying element effects on the uncoated alloy's resistance to low temperature hot corrosion (LTHC). In addition, the nickel-based alloy IN 738 was modified with one and two percent concentrations of hafnium to evaluate the effect of this active element on LTHC resistance. The alloys were ranked into groups of good, moderate or poor, regarding their resistance to LTHC. Relatively high chromium contents were found to be beneficial while relatively high contents of cobalt were unexpectedly determined to be detrimental. The LTHC resistance of IN 738 was improved by small additions of hafnium. This program also showed that the Naval Postgraduate School hot corrosion furnace reproduced the corrosion patterns seen on uncoated alloys in burner rigs and industrial gas turbines.

57308 **(AD-A—111431/3) Evaluation of cast titanium alloy compressor components. Volume I. Final report May 76-Aug 78.** Hammer, A.N. (Solar, San Diego, CA (USA)). Nov 1981. 84p. (RDR—1827-18-VOL-1). NTIS, PC A05/MF A01.

The objective of this program was to characterize the properties of cast titanium alloy compressor impellers to provide a background for design, processing, and qualification for service in the Solar T62T-40 Titan auxiliary power unit and similar small radial gas turbine engines. Four titanium alloy investment casting foundries participated in the production of straight vane test wheels, a low-cost representation of the compressor impellers. As-cast and hot isostatic pressed (HIPed) Ti-6A1-4V was seen to have less than half the high cycle fatigue strength (20 to 30 ksi versus 60 ksi) of equvalent sections from forged and machined impellers. A modified solution heat treatment and aging cycle was developed which restored the fatigue strength to approximately 50 ksi, and which provided adequate tensile strength and ductility. High cycle fatigue strength of weld repaired vanes was significantly lower than that of unwelded, however. Cast and machined wheels offer substantial cost savings over wheels conventionally machined from forgings. These savings may be as much as 50%, or about $900 per wheel.

57309 **(AD-A—111537/7) Erosion mechanisms of metals. Annual report 1 Oct 80-30 Sep 81.** Kubarych, K.G.; Gulden, M.E. (Solar, San Diego, CA (USA)). Nov 1981. 36p. (SR—81-R-4526-02). NTIS, PC A03/MF A01.

The objective of this program is to identify the material properties which control erosion, as well as the material removal process. Based on previous experimental work, an erosion model has been hypothesized and is based on the target stress-strain response beneath the impacting particle. At low particle energies only elastic strain is generated and no damage to the target occurs. At higher energies, the peak stresses increase, leading to brittle fracture or plastic deformation accompanied by adiabatic heating. If adiabatic heating occurs, three possibilities arise. One is a temperature increase with no loss of material, and the second is that ductile fracture may occur due to inadequate ductility at whatever temperature is reached. The third is that localized regions attain the melting point prior to ductile fracture. A complete relationship exists between strain rate, adiabatic heating, and erosion rate. Erosion rate experiments using various particle sizes and velocities and target materials were performed in order to study this relationship. Target materials of 1095 steel, 2024 aluminum and pure molybdenum, copper, and gold were used as well as three Fe-Cr binary alloys.

57310 **(AECL—6302) Hydrogen-induced delayed cracking. I. Strain energy effects on hydrogen solubility.** Puls, M.P. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Aug 1978. 64p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82906298.

Based on Li, Oriani and Darken's derivation of the chemical potential of a solute in a stressed solid and Eshelby's method for obtaining the strain energy of solids containing coherent inhomogeneous inclusions, a detailed theoretical analysis is carried out of the factors governing hydrogen solubility in stressed and unstressed zirconium and its alloys. Specifically, the analysis demonstrates the strong influence hydride self-stresses may have on the terminal solid solubility of hydrogen in zirconium. The self-energy arises due to the misfit strains between matrix and precipitate. A careful analysis is also carried out for the solubility data of Kearns and Erickson and Hardie.

57311 **(AERE-R—10391) Demonstration of on-line plant corrosion monitoring using thin layer activation.** Asher, J.; Webb, J.W.; Wilkins, N.J.M.; Lawrence, P.F. (UKAEA Atomic Energy Research Establishment, Harwell). Dec 1981. 14p. NTIS (US Sales Only), PC A02/MF A01; Also available from H.M. Stationery Office, price Pound2.00. Order Number DE82702340.

The corrosion of a 1 inch water pipe in an evaporative cooling system has been monitored over three periods of plant operation using thin layer activation (TLA). The corrosion rate was followed at a sensitivity of about 1 μm and clearly reflected changes in plant operation. Examination of the test section after removal, both by autoradiography and metallography revealed the extent of corrosion and pitting over the active area.

57312 **(BARC—1135) Irradiation-induced embrittlement of steels used as reactor-pressure-vessel and end shields.** Chatterjee, S.; Sivaramakrishnan, K.S. (Bhabha Atomic Research Centre, Bombay (India). Radiometallurgy Section). 1981. 46p. T. Order Number DE82904603.

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A review of the various factors that influence the irradiation induced changes in mechanical properties of reactor pressure vessel and end shield steel materials have been brought out in this report followed by some typical results on 3 wt % nickel steels and A 302B type of pressure vessel steels. These are the type of steels used in our operating reactors. In this report the irradiation induced mechanical property changes have been analyzed from reported results on nil ductility transition temperature changes (NDTT) from impact tests. The report also brings out the importance of carrying out in reactor surveillance program. 43 references, 13 figures, 9 tables.

57313 **(CEA-CONF—5981) Positron lifetime measurements on electron irradiated amorphous alloys.** Moser, P.; Hautojaervi, P.; Chamberod, A.; Yli-Kauppila, J.; Van Zurk, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Aug 1981. 4p. (CONF-810851—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702348.

From 4. international conference on rapidly quenched metals; Sendai, Japan (24 Aug 1981).

Great advance in understanding the nature of point defects in crystalline metals has been achieved by employing positron annihilation technique. Positrons detect vacancy-type defects and the lifetime value of trapped positrons gives information on the size of submicroscopic vacancy aglomerates and microvoids. In this paper it is shown that low-temperature electron irradiations can result in a considerable increase in the positron lifetimes in various amorphous alloys because of the formation of vacancy-like defects which, in addition of the pre-existing holes, are able to trap positrons. Studied amorphous alloys were $Fe_{80}B_{20}$, Pd_{80} Si_{20}, Cu_{50} Ti_{50}, and $Fe_{40}Ni_{40}P_{14}B_6$. Electron irradiations were performed with 3 MeV electrons at 20 K to doses around 10^{19} e^-/cm^2. After annealing positron lifetime spectra were measured at 77 K.

57314 **(CEA-CONF—6061) Properties of the EM12 (Steel Z10CDNbV 9.2).** Berge, P.; Donati, J.-R.; Pellicani, F.; Weisz, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). Oct 1981. 21p. (In French). (CONF-811069—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702347.

From International conference on production, fabrication, properties, and application of ferritic steels for high-temperature applications; Warren, PA, USA (6 Oct 1981).

EM 12 steel with 9% chromium, 2% molybdenum with added niobium and vanadium appears to be a steel that can be used for the exchanger tubes of steam generators of sodium cooled reactors. A programme for characterizing the mechanical strength of tubes in this steel has been carried out at high temperature. The results of the mechanical tests are described.

57315 **(CEA-R—5101) Monte-Carlo simulation of the evolution of point defects in solids under non-equilibrium conditions.** Maurice, Francoise; Doan, N.V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). Nov 1981. 120p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82702349.

This report was written in order to serve as a guide for courageous users who want to tackle the problem of the evolution of point defect populations in a solid under non-equilibrium conditions by the Monte-Carlo technique. The original program, developed by Lanore in her swelling investigations on solids under irradiation by different particles, was generalized in order to take into account the effects and the phenomena related to the presence of solute atoms. Detailed descriptions of the simulation model, computational procedures and formulae used in the calculations are given. Two examples are shown to illustrate the applications to the swelling phenomenon: first, the effect to temperature or dose rate changes on void-swelling in electron-irradiated copper; second, the influence of solute atoms on the void nucleation in electron-irradiated nickel.

57316 **(CNAEM-R—208) X-Ray studies of depleted uranium sample.** Bayvas, F. (Cekmece Nuclear Research and Training Center, Istanbul (Turkey)). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702343.

In order to determine the composition and the uniformity of the powder crystal distribution of depleted (0.36 % U^{235}) uranium-LG sample, x-ray investigations have been performed. The composition of the sample has been determined as uranium and some of the uranium oxides. The investigations also showed that the distribution of the crystallites is uniform, but the sample is not suitable for neutron diffraction studies because of its composition.

57317 **(DOE/ER/10475—3) Study and modeling of high-temperature fatigue-crack propagation in austenitic stainless steel. Progress report for 1982.** Davidson, D.L. (Southwest Research Inst., San Antonio, TX (USA)). 1 Aug 1982. Contract AS05-79ER10475. 37p. NTIS, PC A03/MF A01. Order Number DE82019509.

Data presented in this paper were derived from dynamic, insitu observations on crack growth in 304SS made at 20° and 600°C under both cyclic and creep conditions. Strains and strain rate distributions within the plastic zone, and crack opening displacements have been determined.

57318 **(DOE/ER/10556—91) Combined macroscopic and microscopic approach to the fracture of metals. Annual progress report, 1981-1982.** Asaro, R.J.; Gurland, J.; Needleman, A. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jul 1982. Contract AC02-80ER10556. 35p. (COO—3084-91). NTIS, PC A03/MF A01. Order Number DE82019950.

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The final results of the recently completed theoretical study of the stress and deformation fields near a growing crack are presented. The shear-lag model has been successfully used to estimate stress in the hard martensite constituent of dual-phase steels under load. The stress values were correlated with the measured strain. In related work, the effect of the size and distribution of hard carbide particles on fracture initiation and fracture toughness was studied in high strength steels, 4140 and 4340, with particular attention to the mode of crack tip advance. The continuing study of the hydrogen assisted fracture of carbon steels was extended to a high carbon steel, i.e., 1095 spheroidized. This steel shows a transition of fracture mode from ductile to cleavage as a function of charging current density. In the area of elevated temperature rupture, a micromechanical model is proposed for creep crack growth by the mechanism of grain boundary void nucleation, growth, and coalescence with the macro-crack.

57319 **(DOE/ER/10972—T1) Influence of nitrogen on the sensitization, corrosion, mechanical, and microstructural properties of austenitic stainless steels. First annual progress report.** Clark, W.A.T.; Macdonald, D.D. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Apr 1982. Contract AC02-81ER10972. 21p. NTIS, PC A02/MF A01. Order Number DE82015263.

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During this first year of the project, the research effort has concentrated on the electrochemical aspects of the effect of nitrogen on austenitic steels. The status of all the individual project tasks are outlined briefly, and then more detailed results of the electrochemical studies conducted so far are reported. Highlights of this quarter are: (1) nitrogen additions of up to 0.16 wt % retard sensitization of 18Cr-8Ni austenitic stainless steels. However, nitrogen additions to levels above ~ 0.25 wt % promote sensitization; (2) the retardation of sensitization by nitrogen can possibly be explained as being due to retardation of the nucleation or rate of growth of chromium carbides; and (3) polarization studies in high temperature 0.01 M Na_2SO_4 solutions at 250°C demonstrate that the sensitized alloys are electrochemically more active than the solution annealed materials thereby indicating that they are susceptible to intergranular attack.

57320 **(EPRI-NP—2492) Inhibition of steam-condensate corrosion of copper-based alloys by hydrazine. Final report.** Beavers, J.A.; Breeze, G.A.; Berry, W.E. (Battelle Columbus Labs., OH (USA)). Jul 1982. 24p. NTIS, PC A02/MF A01. Order Number DE82905847.

An experimental evaluation was made of the potential inhibiting effect of hydrazine on the corrosion of CDA 687 (aluminium brass), and CDA 706 (90 copper - 10 nickel) in a simulated steam condensate containing ammonia under deaerated and partially aerated conditions. It was found that hydrazine inhibited the corrosion of CDA 687 under deaerated conditions, but increased corrosion rates somewhat under partially aerated (1 ppM oxygen) conditions. Corrosion rates of CDA 706 were more than an order of magnitude lower than CDA 687 and were not measurably influenced by hydrazine.

57321 **(EUR—6887-FR) Optimization of steels susceptible to the action of hydrogen. Final report.** Zmudzinski, C.; Pressouyre, G.M.; Bretin, L. (Societe des Forges et Ateliers du Creusot, 58 - Imphy (France). Centre de Recherches des Acieries). 1980. 115p. (In French). European Community Information Service, 2100 M Street, N.W., Washington, DC 20037.

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A description is given for the study and development of steel alloys with nickel, chromium, and molybdenum that are resistant to the action of hydrogen. Results are also given for mechanical tests of the steels. Tabulated data in the appendices are given on the chemical composition, crack propagation, welding characteristics, and microscopic structure. 3 references.

57322 **(IAE—3379/8) Helium flaking in metals and alloys promising as first-wall materials in fusion reactors.** Guseva, M.I.; Ionova, E.S.; Mansurova, A.N.; Martynenko, Yu.V.; Nikol'skij, Yu.V.; Stepanchikov, V.A.; Chelnokov, O.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 44p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702645.

Main peculiar features of flaking (the process of separating an irradiated layer from the metal surface under the pressure of intruded gas) in dependence on radiation doses, target temperature during irradiation, ions energy, orientation and chemical composition of targets are given. A review is represented on flaking in various materials promising for the first wall in fusion reactors under helium ion bombardment. Flaking is observed in the temperature range of 0.1 to 0.45, Tsub(melt) and leads to surface erosion to a greater extent than blistering.

57323 **(IAEA-R—2531-F) Effect of stimulated fission products on the structure and the mechanical properties of Zircaloy. Final report for the period 15 December 1979 - 14 December 1981.** Holub, F. (International Atomic Energy Agency, Vienna (Austria)). Jan 1982. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702345.

The objective of investigation was to study the long-term effects of individual simulated fission products on the mechanical properties and the structure of Zircaloy. Tensile Test specimens of Zircaloy were annealed with important simulated fission products at 350°C up to 10,000 hours and at higher temperatures (500, 700°C) up to 2,000 hours. The principal methods of investigation on annealed Zircaloy specimens were tension tests at room temperature and at 400°C, scanning electron microscopy and microprobe technique, X-ray diffraction, X-ray fluorescence, optical metallography. The action of fission products at normal temperatures of reactor operation will give rise to a small enhancement of strength and a small drop of ductility of the fuel cladding material only. At high fuel pin temperatures which may be realized under abnormal operation conditions, some of the fission products potentially will produce detrimental consequences on the integrity of fuel pins. The most effective fission products will be: lanthanum oxide, followed by the earth alkaline oxides and the other rare earth oxides, molybdenum, iodine and cadmium.

57324 (INIS-mf—7059-Vol.1, pp vp) **Local structure of oxide and metallic glasses.** Gaskell, P.H. (Cambridge Univ. (UK). Cavendish Lab.). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

An attempt is made to delineate current structural problems for oxide glasses, amorphous semiconductors and metallic alloy glasses, and to present a review of relevant experimental investigations on each class of materials. Structural information is dominated by the results of scattering studies (neutrons or X-rays), with growing emphasis being placed on extraction of partial structure factors and accurate comparison with atomic models. EXAFS allows a more detailed investigation of the surroundings of specific atoms, even in complex systems such as oxides and chalcogenides, Moessbauer and NMR spectroscopy have provided new information on the symmetry of first-neighbour coordination shells - particularly in metallic systems. The results of experiments and computer simulations have been evaluated.

57325 (INIS-mf—7059-Vol.1, pp vp) **Positron annihilation in amorphous metals.** Hautojaervi, P.; Yli-Kauppila, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Some recent positron experiments on amorphous alloys have been reviewed. Crystallization, deformation or irradiation have much less effects on the annihilation characteristics than those in crystalline metals. It is concluded that positron annihilation is strongly affected by defects and inhomogenities inherently present in the as-received samples. Various experimental facts support the phenomenon of positron trapping. Electron irradiation at low temperatures has been found to create vacancy-like defects which are able to trap positrons. The annealing of irradiation-induced defects takes place below room temperature.

57326 (INIS-mf—7059-Vol.1, pp vp) **Polarized neutron scattering studies on amorphous solids.** Schweizer, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

In the case of amorphous materials polarized neutrons are used for the measurement of the form factors of magnetic metals, to gain information on the magnetic properties and on the structure of the glass. For compounds containing magnetic atoms, the sensitivity of polarized neutron diffraction allows a direct determination of the partial interference functions. For magnetic atoms with a large anisotropy (as rare earths at low temperature), the local easy direction of the moment is a label for the arrangement of the neighbours around these atoms. The investigation of these easy directions, using polarized neutrons and polarization analysis, gives information on the glass nuclear structure

57327 (INIS-mf—7059-Vol.1, pp vp) **Study of the free volume in $Fe_5Co_{70}Si_{15}B_{10}$ and $Fe_{40}Ni_{40}P_{14}B_6$ systems by positron annihilation.** Andreeff, A. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Brauer, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Fiedler, H. (Zentralinstitut fuer Festkoerperphysik und Werkstoffforschung, Dresden (German Democratic Republic); Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The amorphous systems $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_5Co_{70}Si_{15}B_{10}$ have been investigated in the as-received state and after annealing in the temperature range 25-450 deg C. Both systems show remarkable changes in the S-paramters upon crystallization. For the latter system an additional influence of impurities on the properties in the amorphous state could be observed.

57328 (INIS-mf—7059-Vol.1, pp vp) **Crystallization of various metallic glasses studied by positron annihilation.** Cartier, E.; Heinrich, F.; Kueng, M. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik); Guentherodt, H.J. (Basel Univ. (Switzerland). Inst. fuer Physik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

2γ-angular correlation distributions of positron annihilation radiation show systematic variations during the crystallization of various groups of metallic glasses: metal-metalloid (G1), rare earth-cobalt (G2) and copper-zirconium (titanium) (G3). The variations observed depend on the positron states in the amorphous alloy: positron trapping in vacancy-like defects (G1, G2) trapping at atomic clusters of one of the alloy components (some of G3) or annihilation from delocalized states in the amorphous matrix (some of G3 and $Ca_{70}Mg_{30}$). Positron experiments reveal themselves as a powerful tool for studies of the crystallization kinetics.

57329 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer study of the crystallization of amorphous metals in radio frequency magnetic fields.** Kopcewicz, M. (Warsaw Univ. (Poland)); Gonser, U.; Wagner, H.G. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachbereich Angewandte Physik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

It has been observed that some ferromagnetic amorphous metals crystallize well below their crystallization temperatures when exposed to radio frequency (rf) magnetic fields. We studied this process using Moessbauer spectroscopy on three different amorphous metal samples. The sample with high magnetostriction ($Fe_{40}Ni_{40}B_{20}$) partially crystallized when exposed to rf fields (20.7 and 60.6 MHz). The amorphous metal with zero magnetostriction [$Co_{55}Fe_5Ni_{20}(SiB)_{20}$], however, did not crystallize under the influence of rf fields. This suggests that the main cause of crystallization of amorphous metals in rf fields is magnetostrictively induced vibration. For amorphous $Co_{75}Fe_5B_{15}Si_5$, conversion electron Moessbauer spectroscopy gave evidence of differences between surface and bulk properties.

57330 (INIS-mf—7059-Vol.1, pp vp) **Crystallization of amorphous $Mg_{70}Zn_{30}$ studied by positron annihilation.** Shiotani, N. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)); Tanigawa, S.; Iriyama, H. (Tsukuba Univ., Sakura, Ibaraki (Japan)); Mizoguchi, T. (Gakushuin Univ., Tokyo (Japan). Faculty of Science). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Crystallization process of amorphous Mg-Zn system under isothermal annealing is studied by positron annihilation, X-ray diffraction and electrical resistivity measurements. It is found that the crystallization process consists of two steps. The first step is the cooperative movements of Mg and Zn atoms toward various polyhedral configurations similar to those in the $Mg_{51}Zn_{20}$ crystal. The second step is the formation of grains of the $Mg_{51}Zn_{20}$ crystal.

57331 (INIS-mf—7059-Vol.1, pp vp) **Crystallization of amorphous Cosub(70.3)Fesub(4.7)$Si_{15}B_{10}$; Moessbauer spectroscopy and X-ray diffraction.** Wolny, J. (Institute of Physics and Nuclear Techniques, Krakow (Poland)); Zajac, W. (Uniwersytet Jagiellonski, Krakow (Poland). Inst. Fizyki); Calka, A. (Warsaw Univ. (Poland)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

X-ray diffraction and Moessbauer effect were used to trace the process of recrystallization of an amorphous alloy: Cosub(70.3)Fesub(4.7)$Si_{15}B_{10}$. Five samples were selected following electrical resistivity measurements. Both methods were complementary in establishing transition phases as well as the final composition. Some aspects of deconvoluting distribution of hyperfine parameters from Moessbauer spectra are discussed.

57332 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer effect study of crystallization in Fe-Si-B glasses.** Zaluska, A.; Wronski, Z. (Polska Akademia Nauk, Warsaw. Inst. Fizyki); Baran, M. (Warsaw Univ. (Poland)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57333 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer study of the amorphous alloy Zrsub(100-x)Fesub(x).** Ghafari, M.; Gonser, U.; Wagner, H.G. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachbereich Angewandte Physik); Naka, M. (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The hyperfine field distribution were determined from Moessbauer spectra of $Fe_{91}Zr_9$ for 6 $K<T<230$ K. As in other alloys with invar behaviour, the distribution consists of a high field peak and a broad low field tail. Measurements in external magnetic fields show the ferromagnetic nature of the spin coupling. No evidence was found of an antiferromagnetic component at low fields. For Zr-rich alloys, the distribution of quadrupole splitting was evaluated from the spectra and compared with that found for metastable crystalline alloys. The differences between the two distributions suggest that important changes occur in the short-range order of crystallization. (author).

57334 (INIS-mf—7059-Vol.1, pp vp) **^{9}B Knight shift and line width behaviour of amorphous Be-Nb-Zr and Be-Mo-Zr alloys.** Goebbels, J.; Lueders, K. (Freie Univ. Berlin (Germany, F.R.). Inst. fuer Atom- und Festkoerperphysik); Freyhardt, H.C.; Reichelt, J. (Goettingen Univ. (Germany, F.R.). Inst. fuer Metallphysik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

^{9}Be NMR investigations are reported for amorphous Be-Nb-Zr and Be-Mo-Zr alloys with Nb and Mo concentrations from 2.5 to 7 at%. Line width analysis suggests an enhanced Nb concentration around the Be sites for the Be-Nb-Zr alloys. The Knight shift increases with increasing Nb content whereas the concentration dependence for the Mo samples shows a minimum. This corresponds to the behaviour of the superconducting transition temperature, also suggesting an increased Nb or Mo concentration near the Be sites.

57335 (INIS-mf—7059-Vol.1, pp vp) **Spin texture determination in ribbons of metallic glasses by Moessbauer spectroscopy.** Greneche, J.M.; Henry, M.; Varret, F. (ERA CNRS, Faculte des Sciences, Le Mans Cedex (France)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57336 (INIS-mf—7059-Vol.1, pp vp) **Evaluation of hyperfine field distributions from Moessbauer spectra using Window's Fourier method.** Keller, H. (Illinois Univ., Urbana (USA). Dept. of Physics). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57337 (INIS-mf—7059-Vol.1, pp vp) **Electric field gradient at S-state ions in some amorphous rare earth based alloys.** Maurer, M.; Friedt, J.M.; Sanchez, J.P. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The electric field gradient (EFG) acting at nuclei of RE S-states ions (RE= ^{151}Eu, ^{155}Gd) and at ^{197}Au nuclei has been measured in amorphous (Eusub(1-x)Ybsub(x))$_{80}$Au$_{20}$ and Eusub(77.5)Alsub(22.5) using Moessbauer spectroscopy. These measurements provide information on the local ionic charge distributions. The principal component, Vsub(zz), of the EFG acting at the RE nuclei is found to be large and positive while the asymmetry parameter eta is close to zero. A strong compositional and directional short range order of predominant axial symmetry is deduced. This conclusion is in disagreement with predictions from a DRPHS structural model.

57338 (INIS-mf—7059-Vol.1, pp vp) **Low-field muon spin relaxation studies as a probe of spin-glass dynamics.** Meier, P.F. (Zurich Univ. (Switzerland)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57339 (INIS-mf—7059-Vol.1, pp vp) **^{61}Ni Moessbauer spectroscopy in amorphous alloys.** Oestreich, V.; Schmidt, H.; Goetz, F.; Czjzek, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)); Sostarich, M.; Deppe, P.; Dey, S.; Rosenberg, M. (Bochum Univ. (Germany, F.R.)); Luborsky, F.E. (General Electric Co., Schenectady, NY (USA). Research and Development Center); Coey, J.M.D. 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57340 (INIS-mf—7059-Vol.1, pp vp) **Magnetic properties of amorphous $Fe_4Ni_{74}Si_9B_{13}$.** Shigematsu, T. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research); Keune, W.; Manns, V.; Lauer, J.; Pfannes, H.D. (Duisburg Univ., Duisburg (Germany F.R.). Lab. fuer Angewandte Physik); Naka, M. (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

^{57}Fe Moessbauer measurements have been performed on the amorphous spin-glass alloy $Fe_4Ni_{74}Si_9B_{13}$. Magnetic hyperfine-split spectra are found below an average magnetic transition temperature Tsub(f) approximately 11 K. In the spin-glass phase the hyperfine field near saturation has an average value of (230+-5) kOe and shows a distribution P(H) which is zero for $H<140$ kOe. An external magnetic field strongly affects the spin orientation in the spin-glass phase. For $T>$Tsub(f) in the presence of an external field superparamagnetic clusters exist at least up to 77 K, with an average cluster moment of about 70 μsub(B).

57341 (INIS-mf—7059-Vol.2, pp vp) **Fourier evaluation of broad Moessbauer spectra.** Vincze, I. (Rijksuniversiteit Groningen (Netherlands)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

It is shown by the Fourier analysis of broad Moessbauer spectra that the even part of the distribution of the dominant hyperfine interaction (hyperfine field or quadrupole splitting) can be obtained directly without using least-square fitting procedures. Also the odd part of this distribution correlated with other hyperfine parameters (e.g. isomer shift) can be directly determined. Examples for amorphous magnetic and paramagnetic iron-based alloys are presented.

57342 (INIS-mf—7059-Vol.2, pp vp) **Extensive study of metallic glasses by positron annihilation.** Kajcsos, Zs.; Lovas, A.; Kisdi-Koszo, E.; Kiss, D.; Szeles, Cs. (Koezponti Fizikai Kutato Intezet, Budapest (Hungary)); Marczis, L. (Vasipari Kutato Intezet, Budapest (Hungary)); Brauer, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Three positron annihilation techniques were applied to investigate amorphous metals. Samples of $Fe_{40}Ni_{40}Si_{14}B_6$ and $Fe_{40}Ni_{40}P_{16}B_6$ were prepared from melt spun with constant ejection pressure and orifice but varying quenching rate and melt temperature. The influence of the production process leading to different Hsub(c) for the samples, the effects of heat treatment, cold rolling and electron irradiation were studied. The measured dependences of positron annihilation parameters on the above treatments indicate the presence of positron-active trapping centres in the amorphous phase.

57343 (INIS-mf—7059-Vol.2, pp vp) **Time-of-flight neutron diffraction study of $Ni_{60}Nb_{40}$ and $Fe_{81}B_{19}$ metallic glasses.** Svab, E.; Forgacs, F. (Koezponti Fizikai Kutato Intezet, Budapest (Hungary)); Ishmaev, S.N.; Sadikov, I.P.; Chernyshov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Time-of-flight linac neutron diffraction studies were performed on splat-cooled $Ni_{60}Nb_{40}$ and $Fe_{81}B_{19}$ metallic glass samples. The structure factor was measured up to high momentum transfers, Qsub(max)=26 A^{-1} with high resolution (Δr approximately 0.24 A) for the distribution function obtained by Fourier transformation. For $Fe_{81}B_{19}$, partial coordinations could be resolved resulting in rsub(Fe-Fe)=2.55 A, rsub(Fe-B)=2.18 A first neighbour atomic distances, and nsub(Fe-Fe)=10.6, nsub(Fe-B)=1.95, nsub(B-Fe)=8.3 partial coordination numbers. For $Ni_{60}Nb_{40}$, no splitting of the first peak of the distribution function was observable.

57344 (INIS-mf—7059-Vol.2, pp vp) **Structure investigations of electrodeposited nickel.** Vertes, A.; Czako-Nagy, I.; Lakatos-Varsanyi, M. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary). Fizikai Kemiai es Radiologiai Tanszek); Kajcsos, Zs. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics); Csordas, L. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary)); Brauer, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Leidheiser, H. Jr (Lehigh Univ., Bethlehem, PA (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Electrodeposited nickel samples were investigated by positron annihilation (lifetime and Doppler-broadening), Moessbauer effect and X-ray diffraction measurements. Two-component positron lifetime spectra were obtained. The first component is thought to result from bulk annihilation and trapping at single trapping centres (TC), their concentrations are obtained from the trapping model. The second one possibly denotes annihilation at voids, the number of which is dependent on the stress in the deposit. The Moessbauer results show differences in the magnetic orientation in the three samples examined.

57345 (INIS-mf—7059-Vol.2, pp vp) **Moessbauer study of interphase formation at the interface of the electrodeposited tin layer and iron substrate.** Vertes, A.; Nagy, S.; Awad, M.Z. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary). Fizikai Kemiai es Radiologiai Tanszek). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Fe foil substrates were used for the electrodeposition of ^{119}Sn. The samples were measured before and after heat treatments at 373, 423 and 473 K. Intermetallic interphases were formed even without heating. Diffusion data also were obtained.

57346 (INIS-mf—7059-Vol.2, pp vp) **Electron momentum distribution in amorphous metals investigated by positron annihilation.** Kristiakova, K.; Kristiak, J. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Galan, P. (Inst. of Preventive Medicine, Bratislava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57347 (INIS-mf—7059-Vol.2, pp vp) **Application of positron annihilation for structure study of metallic glasses.** Kajcsos, Zs.; Kemeny, T. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:; Brauer, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

A brief critical overview is given on structural models for describing metallic glasses, on positron annihilation methods and on their applications for studying metallic glasses. Results from the literature are presented, compared and discussed.

57348 (INIS-mf—7059-Vol.2, pp vp) **Comparative study on $Fe_{32}Ni_{36}Cr_{14}P_{12}B_6$ metallic glass and its polycrystalline modification bombarded by 2000 keV helium ions with high fluence.** Manuaba, A.; Paszti, F.; Pogany, L.; Fried, M.; Kotai, E.; Mezey, G.; Lohner, T.; Lovas, I.; Pocs, L.; Gyulai, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:. 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Surface deformations on both amorphous and polycrystalline METGLASS 2826A alloy caused by high dose bombardment of helium ions of energy 2 and 3.52 MeV were examined by RBS analysis and SEM. Both observations confirm that the resistance of the amorphous form against flaking is 70% higher. For higher energy bombardment and higher current density the surface deformations are characterized by competition of two processes, i.e. exfoliation and flaking, presumably due to temperature effects.

57349 (INIS-mf—7093, pp vp) **Electroslag remelting of steels used in nuclear power engineering.** Masek, Z.; Brozik, J. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

Experimental data are presented as obtained in laboratory-scale electroslag remelting of steels 15Kh2MFA, A543 and CSN 17249 used for the manu+.acture of reactor pressure vessels and their internals. They show that while tensile and creep properties remain unchanged, metallurgical purity of the steel was increasing, the direction of sampling minimally affected the mechanical values of samples, plastic properties were improving and resistance to brittle fracture was growing. (B.S.).

57350 (INIS-mf—7093, pp vp) **Phase composition of hardable paramagnetic steels with various C and V contents.** Cap, A. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The effects of solution annealing temperature and the structure following precipitation hardening were investigated on system 18Mn4Cr1Ni with variable carbon and vanadium contents. In the basic systems of carbon contents of 0.2; 0.5; 0.75% the vanadium content was graded by 0.5% between 0 and 2.5%. The optimum hardening temperature of solution annealing was found to be 1150 degC, 0.5% was sufficient carbon content. The time of attaining the highest hardness temperature was found dependent on the vanadium content at the same carbon content. Vanadium was found to be the main element controlling diffusion processes during hardening. The phase composition of the system was uneven and depended on the V:C ratio. The basis consisted o+. austenite in whose grains V_4C_3 particles were found after hardening, which mostly contributed to the increased hardness of the system. (J.P.).

57351 (INIS-mf—7093, pp vp) **Effect of carbon and aluminium contents on the properties of forgings from chromium-nickel austenitic steel.** Sedivec, J. (Skoda, Plzen (Czechoslovakia)); Kratochvil, P. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The experimental melts were prepared from master alloy by fusion in an induction crucible furnace such that the content of carbon in the individual melts was graded between 0.05% and 0.11% and the aluminium content ranged between 0.02 and 0.07% and between 0.19 and 0.43%. The chemical compositions of the alloys are shown. Bars of 40 x 40 mm in section were forged from each ingot. Part of specimens was solution annealed to 1050 degC for over 4 h, other specimens were annealed to 1020 degC. After heat treatment, 10 mm dia test bars were produced for determining the tensile strength. Mechanical properties were determined at a temperature of 350 degC. Grain size was studied for each specimen. It was shown that an increased aluminium content in Cr18Ni10 type steel increased the σΞsub(0,2) value at 350 degC. Carbon was found to show a higher hardening effect. Heat treatment affected the yield point, the effect increasing with carbon content. The experiments showed that aluminium in an amount of several per mill had a slight hardening effect and also affected grain refining. (J.P.).

57352 (INIS-mf—7093, pp vp) **Radiation stability of steel for 440 MW reactor pressure vessel.** Brumovsky, M. (Skoda, Plzen (Czechoslovakia)); Vacek, M.; Havel, S. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

Radiation embrittlement is statistically evaluated for steel 15Kh2MFA, this both in absolute terms and in comparison with steel ASTM-A533-B. The results show that the former is more resistant to radiation damage than other steels used for the manufacture of reactor pressure vessels, the resistance resulting from the absence of nickel on the one hand and on the other from a high level of vanadium. The steel is thus very suitable for the manufacture of reactor pressure vessels. (J.B.).

57353 (INIS-mf—7093, pp vp) **Problems of manufacturing special steels for WWER 440 reactor internals.** Barackova, L.; Kepka, M.; Mocek, J.; Pechman, V.; Perlik, J. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

The characteristics, metallurgy, forming and heat treatment are discussed for high-alloy steels of the 1Kh13N3, 20Kh17N2B-Sh, KhN35VT(-VD), 10Kh11N20T3R types and for alloy KhN77TYuR in laboratory or pilot plant situations. The results of assessing the quality and the properties of the steels are presented.

57354 (INIS-mf—7093, pp vp) **Spring steel 12Kh18N10T for WWER reactor internals.** Houska, F.; Velkoborsky, J. (Skoda, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

Mechanical requirements for spring wire made of stainless steel 12Kh18N10T are given including the steel-making technology, chemical composition, mechanical properties, rated dimensions, the properties of the wire surface, and resistance to intergranular corrosion. The results of testing showed that the values measured corresponded to specifications.

57355 (INIS-mf—7095, pp vp) **Boriding of hard metals.** Majer, Z. (Forschungsinstitut fuer die Pulvermetallurgie, Sumperk (Czechoslovakia)). 1981. (In Russian). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57356 (INIS-mf—7095, pp vp) **Formation of hard metal phases in titan by implantation of boron, carbon or nitrogen.** Rauschenbach, B.; Kolitsch, A.; Richter, E.; Hohmuth, K. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57357 (INIS-mf—7096, pp vp) **Properties of Ni-Mo steel prepared from premixed and prealloyed powder in sintered, forged and annealed state.** Salak, A.; Hrubjak, M. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

Investigated were 2Ni-0.5Mo steel specimens made of premixed powder on the base of Hametag iron and of ATST-A prealloyed powder with graphite additives of 0.3% and 0.8%. In the sintered and forged state, specimens prepared from premixed powder exhibit better strength properties compared with those made of prealloyed ATST-A powder. After annealing, the carbon content has a different bearing on both systems. With premixed powder steel of 0.6% carbon content the tensile strength amounts to 1,800 MPa whilst that of prealloyed steel specimens with 0.2% carbon content is about 1,240 MPa. (author).

57358 (INIS-mf—7167) **Influence of Ti in the β-Zr(Fe) phase stability at ambient temperature.** Coelho, J.S. (Minas Gerais Univ., Belo Horizonte (Brazil). Escola de Engenharia). Dec 1980. 79p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780734.

Thesis.

Investigations of the Fe-Ti-Zr alloy system with concentrations ranging from 1 at.% Ti to 20 at.% Ti and with a fixed concentration of 4 at.% Fe were performed using X-Ray diffraction, Mossbauer Spectroscopy and Optical and Electronic Metallographies. The alloys were melted in arc furnace in argon atmosphere and after being homogenized, they were quenched from the beta field into cold water in order to retain the high temperature β-Zr(Fe)-Ti phase. The obtained results show that the beta phase was partially retained until the concentration of 7 at.% Ti and was completely retained at the concentration equal to or higher than 8 at.% Ti. It is assumed in Moessbauer Spectroscopy a doublet for the beta phase and a singlet for the supersatured α'-Zr(Fe)-Ti phase resulting from the martensitic transformation. The relative amount of each phase detected by Moessbauer Spectroscopy was measured by the relative area of the each spectral line. The stability of the beta phase at room temperature was discussed in terms of short-range ordering caused by the Fe-Ti bonds. Some related properties were discussed through the changing of the lattice parameter, isomer shift and quadrupole splitting.

57359 (INIS-SU—86, pp 132) **Interaction in systems formed by tin(lead)- and rare earth (or thallium) chalcogenides.** Gurshumov, A.P.; Akhmedov, A.M.; Kadirli, Kh.V.; Sadykova, L.N.; Safarov, D.M.; Bakhshalieva, K.A.; Gadzhiev, Eh.I. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57360 (INIS-SU—86, pp 138) **Structural-chemical transformations in melts of systems with intermediate phases melting incongruently.** Sokolov, E.B.; Glazov, V.M. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57361 (INIS-SU—111, pp 35-38) **Ionic conductivity of fluorite-type fluorides.** Hagenmuller, P.; Reau, J.M.; Lucat, C.; Mater, S.; Villeneuve, G. (Bordeaux-1 Univ., 33 (France)). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57362 (IS-RIC-PR—1) Critical evaluation of binary rare earth phase diagrams. Progress report, September 1, 1981-November 30, 1981. Gschneidner, K.A. Jr.; Calderwood, F.W. (Iowa State Univ. of Science and Technology, Ames (USA). Energy and Mineral Resources Research Inst.). Dec 1981. Contract W-7405-ENG-82. 52p. NTIS, PC A04/MF A01. Order Number DE82018270.

The purpose of this project is to present a critical evaluation of the known rare earth binary phase diagrams. In addition to reviewing the known phase relationships, crystallographic and thermodynamic data where available will be used in the evaluation. Other physical property data which may be appropriate will also be used. These would include: hardness, electrical resistivity, superconductivity, magnetic susceptibility, NMR, Moessbauer, etc., measurements. Information for each of the binary intra-rare earth alloys systems and each of the rare earth metal - non-rare earth metal binary alloy systems will be evaluated. Ternary and higher order systems are beyond the scope of this project.

57363 (IS-RIC-PR—2) Critical evaluation of binary rare earth phase diagrams. Progress report, September 1, 1981-November 30, 1981. Gschneidner, K.A. Jr.; Calderwood, F.W. (Iowa State Univ. of Science and Technology, Ames (USA). Energy and Mineral Resources Research Inst.). Mar 1982. Contract W-7405-ENG-82. 147p. NTIS, PC A07/MF A01. Order Number DE82018267.

This report is a continuation of our first quarterly report IS-RIC-PR-1 (December 1981). Occasionally reference is made to data quoted in this earlier report, and the reader should refer to this report for this information. The pagination, section numbers and table numbers are a continuation from IS-RIC-PR-1.

57364 (JINR-R—8-81-182) Heat capacity and upper critical magnetic field of Nb-Ti alloys after helium implantation and heat treatment. Vasilev, P.G.; Goncharov, I.N.; Petrova, L.V.; Osipova, N.M.; Khertsog, R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702646.

Experimental results on heat capacity and upper critical magnetic field of Nbsub(1-x)Tisub(x) (x<=0.2) alloys cold deformed (98%), recrystallized at 1000, 1100 and 1250 deg C, the He^+ implanted at room conditions and reannealed (after irradiation) at 1000-1200 deg C are presented. Data on residual electrical resistivity, residual resistivity ratio Rsub(300)/Rsub(n) and transition temperature Tsub(c) are also given. The attempt is made to interpret the results obtained on the basis of available data on specimen microstructure in the framework of modern theoretical models.

57365 (Juel-Spez—128) Temperature dependence of tensile properties of 316 stainless steel, FeCrNiMo, FeCrNi, Ni-W and Ni foils. Parente, C.B.R.; Jung, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Sep 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82906231.

Foil specimens in the 20 to 200 μm thickness range are increasingly employed in light ion simulation studies of neutron induced changes of mechanical properties. In order to elucidate the importance of thickness effects in relation to other parameters (composition, thermomechanical treatment) tensile tests were performed on 50 μm thick foil samples in the 0^0 to 800^0C temperature range for a series of alloys in the annealed and 20% cold worked condition. Commercial type 316 stainless steel, a FeCrNiMo and a FeCrNi alloy of similar composition, a Ni-W alloy and pure Ni were investigated. The results for SS 316 were compared with data from 200 μm thick foils and bulk material. In the annealed materials the relatively large influence of composition on tensile properties prevented safe conclusions about the effect of specimen thickness. In the cold worked alloys, however, the influence of composition was small compared to the strong reduction of tensile strengths and ductility in the thin specimens. Electrical resistivity measurements are presented on these materials as a function of temperature.

57366 (LBL—14664) Electron paramagnetic resonance at dislocations in germanium. Pakulis, E.J. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract AC03-76SF00098. 93p. NTIS, PC A05/MF A01. Order Number DE82020070.

Thesis. Portions of document are illegible.

The first observation of the paramagnetic resonance of electrons at dislocations in germanium single crystals is reported. Under subband gap optical excitation, two sets of lines are detected: four lines about the <111> axes with g/sub perpendicular to/ = 0.34 and g/sub parallel/ = 1.94, and 24 lines with g/sub perpendicular to/ = 0.73 and g/sub parallel/ = 1.89 about <111> axes with the six-fold 1.2^0 distortion. This represents the first measurement of the disortion angle of a dislocation dangling bond. The possibility that the distortion results from a Peierls transition along the dislocation line is discussed.

57367 (LBL—14668) Influence of alloy microstructure on Al_2O_3-peg morphologies in CoCrAl alloys and coatings. Pendse, R.D. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract AC03-76SF00098. 68p. NTIS, PC A04/MF A01. Order Number DE82020336.

Thesis.

A comparative study of Al_2O_3-peg morphologies in oxidized Co10Cr11A11Y and Co10Cr11A11Hf as-cast alloys was carried out with a view to examine the role of alloy/coating microstructure in the pegging process. No direct connection between the two was established. However, deeply penetrating internal Al_2O_3-sheaths were observed associated with the microstructurally segregated yttride phase at the α/β boundaries in the oxidized CoCrAlY alloy; no sheaths were found in the CoCrAlHf alloys. These observation in conjunction with previous observations of sheaths in vapor-deposited coatings are considered as evidence of an indirect influence of microstructure on the pegging process. A zone depleted of the β-phase was observed below the scale in all oxidized alloys. Simple observations and calculations on the zone-thickness were made with a view to elucidate the pegging mechanism. These were not entirely conclusive and additional work was found necessary.

57368 (NUREG/CR—2487) Evaluation of IAEA coordinated program steels and welds for 288 deg C radiation embrittlement resistance. Hawthorne, J.R. (Naval Research Lab., Washington, DC (USA)). Feb 1982. 47p. (NRL-MR—4655). NTIS, PC A03/MF A01.

Eight steel materials supplied by the Federal Republic of Germany, France and Japan to the International Atomic Energy Agency (IAEA) Program on 'Analysis of the Behavior of Advanced Reactor Pressure Vessel Steels Under Neutron Irradiation' were irradiated at 288C for assessments of relative notch ductility and dynamic fracture toughness change with approximately 2 x 10 to the 19th power n/sq cm, E >1 MeV. Notch ductility and fracture toughness were determined, respectively, by Charpy-V and fatigue precracked Charpy-V test methods. An A533-B steel plate (HSST 03) produced in the USA was included in the irradiation test series for reference.

57369 (NUREG/CR—2511) Status of knowledge of radiation embrittlement in USA reactor pressure vessel steels. Hawthorne, J.R. (Naval Research Lab., Washington, DC (USA)). Feb 1982. 38p. (NRL-MR—4737). NTIS, PC A03/MF A01.

Advances by experimental research in the USA toward an improved understanding of property changes in steel by elevated temperature (approximately 288C) irradiation are summarized. Four areas of investigation are reviewed including the confirmation and demonstration of guidelines for radiation resistant steels, the isolation of metallurgical factors contributing to variable radiation embrittlement sensitivity, the qualification of in situ heat treatments for periodic vessel embrittlement relief, and the correlation of notch ductility and fracture toughness changes with irradiation. Overall, the current state of the art provides both a high capability for tailoring steels for radiation service in new vessel construction and a promising method for controlling radiation embrittlement buildup in existing vessel construction.

57370 (NUREG/CR—2794) Computer use in the high-temperature mechanical/metallurgy testing laboratory. Cross, R.W.; Hufnagel, R.J. (Sandia National Labs., Albuquerque, NM (USA); EG and G, Inc., Albuquerque, NM (USA)). Jun 1982. Contract AC04-76DP00789. 39p. (SAND—82-0799). NTIS, PC A03/MF A01 - GPO.

High speed digital computers have come into use in the high temperature metals testing laboratory. This paper presents some of the advantages and disadvantages of the use of computers for test control, data acquisition, and the graphing of test results. While tests have been run for years without the use of computers, the significant enhancements offered by the computer in accuracy, repeatability, user interaction, and management of large amounts of data make the use of computers almost mandatory when data from many tests by different laboratories are compared and evaluated. The particular case of the use of MTS hydraulic test frames with the DEC PDP-11/34 computer is treated here, under the assumption that other computer-based systems would display similar advantages and similar problems.

57371 (ORNL—5896) Near surface modification: new techniques and applications in materials science. Appleton, B.R.; Koch, C.C.; DeVan, J.H.; Farrell, K; Lewis, M.B.; Raman, S.; Tortorelli, P.F.; Williams, J.M. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 131p. NTIS, PC A07/MF A01. Order Number DE82020704.

This report reviews several new materials processing techniques or new applications of some existing techniques which have lead to new materials modifications. It is intended to acquaint ORNL researchers with the capabilities of these techniques and the facilities which exist at ORNL. Section I contains the rationale and motivation for this report and discusses the extent to which the near-surface regions of materials can be modified utilizing the various techniques. The near-surface modification techniques themselves are described in Section II. The more established techniques considered are physical and chemical vapor deposition and liquid quenching. Particular emphasis is placed on the newer techniques of ion implantation doping, pulsed laser annealing and ion-beam and pulsed-laser mixing. Four areas were singled out for consideration in Section III and the usefulness of these near-surface modification techniques in these areas were assessed.

57372 (ORNL/TM—8075) Analysis of elevated-temperature tensile and creep properties of normalized and tempered 2 1/4 Cr-1 Mo steel. Booker, M.K.; Booker, B.L.P.; Swindeman, R.W. (Oak Ridge National Lab., TN (USA)). Jan 1982. Contract W-7405-ENG-26. 57p. NTIS, PC A04/MF A01. Order Number DE82007472.

Portions of document are illegible.

Tensile and creep data were collected for normalized and tempered 2 1/4 Cr-1 Mo steel from American, Japanese, British, French, and German sources. These included creep data obtained at temperatures from 427 to 600°C (800 to 1112°F) and tensile data from room temperature to 550°C (1022°F). Properties examined included yield strength, ultimate tensile strength, 10^5-h creep-rupture strength, and 10^{-5}%/h creep strength. These are the properties used in setting allowable stresses for Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code. The data were analyzed by using lot-centered regression approaches that yielded expressions for the variations in the above properties with loading condition, as well as accounting for lot-to-lot variations in properties. No indications were found of systematic differences in any of the properties examined for data from the different countries. However, the estimated allowable stresses from this investigation fell up to 10% below those currently given for this material in the ASME Code. Several possible reasons were cited for the differences, and we concluded that our results are not overly conservative. On the other hand, there is no direct evidence that the current code allowable stresses are insufficiently conservative, since those stresses rely on factors (such as service experience) other than experimental data.

57373 (PB—82-152687) Strength and toughness of USSR Fe-20Cr-16Ni-6Mn-0.2N weldments at cryogenic temperatures. Final report. Yushchenko, K.A.; Paton, E.O.; Reed, R.P.; Tobler, R.L.; Elmer, J.W. (National Bureau of Standards, Washington, DC (USA)). 1980. 5p. Pub. in Proceedings of the International Cryogenic Engineering Conference (8th), Genova, Italy, June 3-6, 1980, p797-801.

The structural reinforcement of large superconducting magnets normally requires the use of a very strong tough alloy at liquid helium temperature. The base and weldment material of a Soviet austenitic stainless steel, a nitrogen-strengthened Fe-20Cr-16Ni-6Mn alloy, is evaluated and compared with conventional AISI 300 series stainless steels (Fe-18Cr-8Ni). Tensile and fracture toughness measurements were made on base, heat-affected zone and weld material. Both tungsten inert gas and submerged arc weld processes, using 20 mm thick plate, were used. Magnetic measurements were made after deformation and tensile flow strengths were compared with the temperature dependence of stable austenitic stainless steels to assess the occurrence and influence of martensitic phase transformations on low temperature properties. J-integral fracture toughness was measured and the base and weldment properties compared.

57374 (PB—82-155169) Thermal expansion of several materials for superconducting magnets. Final report. Clark, A.F.; Fujii, G.; Ranney, M.A. (National Bureau of Standards, Washington, DC (USA)). Sep 1981. 4p. Proceedings of Int. Conf. Magnet Technology held at Karlsruhe, West Germany on March 30-April 5, 1981, IEEE Trans. Magn. MAG-17, n5 p2316-2319, Sep 81.

The thermal expansion of several materials used in the construction of high field superconducting magnets has been measured from 4 K to room temperature. The materials were a NbTi and two A15 multifilamentary conductors and several nonmetallic composites made from linen/phenolic, fiberglass/epoxy and superconducting wire/epoxy.

57375 (PB—82-158940) Magnetic properties of alloys containing mischmetal, cobalt, copper, iron, and magnesium. Report of investigations/1981. Walkiewicz, J.W.; Winston, J.S.; Wong, M.M. (Bureau of Mines, Reno, NV (USA). Reno Research Center). Dec 1981. 29p. NTIS, PC A03/MF A01.

The Bureau of Mines investigated alloys containing mischmetal (MM), cobalt, copper, magnesium, and iron for use in permanent magnets in place of the scarce samarium-cobalt alloys. The magnetic properties of MM-Co, MM-Co-Cu, MM-Co-Cu-Mg, and MM-Co-Cu-Fe-Mg alloys were evaluated. Magnets were fabricated by powder metallurgy consisting of arc-melting the metals, crushing and grinding the resultant alloys, alining and compacting the powder, and sintering the compacts.

57376 (PB—82-170739) Second report on sintering diagrams. Swinkels, F.B.; Ashby, M.F. (Cambridge Univ. (UK). Dept. of Engineering). Apr 1980. 88p. NTIS, PC A05/MF A01.

Sintering-mechanism diagrams are diagrams with axes of neck-size or density, and temperature, which identify the fields of dominance of each of the several mechanisms which contribute to sintering, and show the rate or extent of sintering that all the mechanisms, acting together, produce. The present paper incorporates certain new ideas about sintering into the diagrams: the coupling of boundary diffusion and surface diffusion; new criteria for the stages of sintering; and an approximate treatment of particle rearrangement. Diagrams showing how both the neck size and the density of compacts of wires and of spheres change with time and temperature are developed. Their use is illustrated by an analysis of a large body of sintering data for both wires and spheres of Ag, Cu, Ni, Fe, W, NaCl and Stainless Steel.

57377 (PB—82-178609) Fracture-mechanism maps. Ashby, M.F. (Cambridge Univ. (UK). Dept. of Engineering). 1981. 73p. NTIS, PC A04/MF A01.

This paper describes the development of elementary fracture mechanism maps. These are diagrams with tensile stress as one axis and temperature as the other, showing the fields of dominance of a given micromechanism of fracture: cleavage, ductile fracture, rupture, intercrystalline creep fracture, and so on. Superimposed on the fields are contours of constant time-to-fracture. They can be constructed in either of two ways: empirically, by assembling observations and data for the fracture of a given material; and theoretically, via models for the individual fracture mechanisms. The two approaches complement each other; both are presented here. The maps give an overview of the micromechanisms by which a given material may fail, and help identify the one most likely to be dominant in a given experiment, or an engineering application. They should give guidance in selecting materials for high temperature use, and in the extrapolation of creep-rupture data.

57378 **(SAND—82-8703) Solidification and solid state transformations of austenitic stainless steel welds.** Brooks, J.A.; Williams, J.C.; Thompson, A.W. (Sandia National Labs., Livermore, CA (USA); Carnegie-Mellon Univ., Pittsburgh, PA (USA)). May 1982. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01. Order Number DE82015081.

The microstructure of austenitic stainless steel welds can contain a large variety of ferrite morphologies. It was originally thought that many of these morphologies were direct products of solidification. Subsequently, detailed work on castings suggested the structures can solidify either as ferrite or austenite. However, when solidification occurs by ferrite, a large fraction of the ferrite transforms to austenite during cooling via a diffusion controlled transformation. It was also shown by Arata et. al that welds in a 304L alloy solidified 70-80% as primary ferrite, a large fraction of which also transformed to austenite upon cooling. More recently it was suggested that the cooling rates in welds were sufficiently high that diffusionless transformations were responsible for several commonly observed ferrite morphologies. However, other workers have suggested that even in welds, $\delta \rightarrow \gamma$ transformations are diffusion controlled. A variety of ferrite morphologies have more recently been characterized by Moisio and coworkers and by David. The purpose of this paper is to provide further understanding of the evaluation of the various weld microstructures which are related to both the solidification behavior and the subsequent solid state transformations. To accomplish this, both TEM and STEM (Scanning Transmission Electron Microscopy) techniques were employed.

57379 **(UCRL—87370) Cause of pitting in beryllium.** Kershaw, R.P. (Lawrence Livermore National Lab., CA (USA)). 16 Apr 1982. Contract W-7405-ENG-48. 25p. (CONF-820459—2). NTIS, PC A02/MF A01. Order Number DE82019433.

From Beryllium subwog meeting; Denver, CO, USA (19 Apr 1982).

Portions of document are illegible.

Light microscopy, bare-film radiography, secondary ion mass spectroscopy, electron microprobe and physical testing were used to examine beryllium specimens exhibiting a stratified, pitted, pattern after chemical milling. The objective was to find the cause of this pattern. Specimens were found to have voids in excess of density specification allowances. These voids are attributed, at least in part, to the sublimation of beryllium fluoride during the vacuum hot pressing operation. The origin of the pattern is attributed to these voids and etching out of fines and associated impurities. Hot isostatic pressing with a subsequent heat treatment close residual porosity and dispersed impurities enough to correct the problem.

57380 **(Y/DW—361) Ultrasonic determination of grain size in uranium.** Brosey, W.D. (Oak Ridge Y-12 Plant, TN (USA)). 19 Jul 1982. Contract W-7405-ENG-26. 19p. (CONF-820820—2). NTIS, PC A02/MF A01. Order Number DE82019419.

From Review of progress in quantitative NDE; San Diego, CA, USA (1 Aug 1982).

An ultrasonic technique has been developed that enables the measurement of grain size in uranium without metallographic preparation or destructive analysis. Pitch-catch ultrasonic analysis using transverse (shear) waves was conducted in the determination of grain size in wrought uranium parts.

57381 **Vapor pressure and thermodynamics of Bk-249 metal.** Ward, J.W.; Kleinschmidt, P.D.; Haire, R.G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **77**: No. 3, 1464-1468(1 Aug 1982).

The vapor pressure of ^{249}Bk metal has been measured over the range 1100—1500 K, using combined target and mass spectrometric Knudsen effusion techniques. Vapor pressure data are combined with an appropriate estimate for the solid heat capacity and the estimated crystal entropy S^0_{298}, to produce enthalpy, entropy, and free energy functions from 298 to 2000 K. The vapor pressures are described by the equations: Log_{10} P(atm) = -(15 718 +- 253)/T+578 +- 0.21 [solid, 1107—1319 K], Log_{10} P(atm) = -(14 902 +- 244)/T+5.14 +- 0.17 [liquid, 1345—1528 K] from which we calculate ΔH^0_{298} (2nd law) = 73 960 +- 1150 cal/mol [solid], ΔH^0_{298} (2nd law) = 73 980 +- 1120 cal/mol [liquid], and ΔH^0_{298} (3rd law) = 74 220 +- 180 cal/mol [solid and liquid].

57382 **Self-field effects in superconductor-normal metal-superconductor junctions.** Nagata, S.; Yang, H.C.; Finnemore, D.K. (Ames Laboratory-USDOE and Department of Physics, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **53**: No. 8, 5798-5801(Aug 1982). Contract W-7405-ENG-82.

The temperature dependence of the dc Josephson critical supercurrent has been measured for square lead-zinc-lead (superconductor-normal metal-superconductor) junctions in order to make a quantitative study of self-field effects. Correction for the critical current density, J/sub c/, due to the self-field effect is made by using the linearized two-dimensional model proposed by Vaglio. We calculate the temperature dependence of the Josephson penetration depth, λ/sub J/ and find J/sub c/ to be proportional to (1-T/T/sub c/)^2 in the range where λ/sub J/ is comparable to the junction width, W.

57383 **Structural studies of Schottky barrier formation by means of surface EXAFS: Pd and Ag on Si(111) 7 x 7.** Stoehr, J.; Jaeger, R. (Corporate Research Science Laboratories, Exxon Research and Engineering Company, Linden, New Jersey 07036). *Journal of Vacuum Science and Technology;* **21**: No. 2, 619-623(Jul 1982).

The initial stages of Schottky barrier formation for Pd and Ag on Si(111) 7 x 7 have been investigated by means of surface extended x-ray absorption fine structure (SEXAFS) measurements above the metal L_2 absorption edges. For Pd deposition at room temperature (RT) and 1.5 monolayer coverage the local structure around the Pd atoms is found to closely resemble that of a thick (~300 A) Pd_2Si layer grown on Si(111). The Ag/Si system exhibits a distinctly different interface formation. At RT and around 2.5 monolayers Ag coverage the SEXAFS spectrum is found to be identical to Ag metal. Upon heating to 500 °C a $\sqrt{3}$ x $\sqrt{3}$ LEED pattern is observed and the polarization dependent SEXAFS signal reveals that the LEED pattern is due to Ag atoms in a threefold site on Si(111) with a Ag—Si distance of 2.45 +- 0.05 A. At higher Ag coverage the periodic $\sqrt{3}$ x $\sqrt{3}$ Ag sites on the annealed (500 °C) surface are accompanied by large Ag clusters. The derived structural models are discussed in comparison with various models suggested previously.

57384 **Suppression of spin fluctuations in UAl_2 in high magnetic fields.** Franse, J.J.M.; Frings, P.H.; de Boer, F.R.; Menovsky, A.; Beers, C.J.; van Deursen, A.P.J.; Myron, H.W.; Arko, A.J. (Natuurkundig Laboratorium der Universiteit van Amsterdam, 1018-XE Amsterdam, The Netherlands). *Physical Review Letters;* **48**: No. 25, 1749-1752(21 Jun 1982).

Magnetization and magnetoresistivity measurements near 4.2 K on UAl_2 in fields up to 35 and 25 T, respectively, show a suppression of spin fluctuations in this material between 15 and 20 T. The experiments strongly suggest that the field and temperature effects on the paramagnon contributions are closely related. The validity of various theoretical models on the suppression of paramagnon effects are also discussed in light of these measurements.

57385 **Polymorphism of nickel-phosphorus metallic glasses.** Lashmore, D.S.; Bennett, L.H.; Schone, H.E.; Gustafson, P.; Watson, R.E. (National Bureau of Standards, Washington, D. C. 20234). *Physical Review Letters;* **48**: No. 25, 1760-1763(21 Jun 1982). Contract AC02-76CH00016.

It is shown that nickel-phosphorus metallic glass alloys not only exhibit two distinct local structural configurations for a given composition, but also that the configuration can be selected by choosing the appropriate processing parameters. It is also shown that the structure exhibiting the greater Knight shift exhibits a discontinuous transformation to the structure with the lower Knight shift. Measurements have been extended to amorphous alloys containing up to 42 at.% phosphorus.

57386 **Extended x-ray absorption fine-structure investigation of Nb$_3$Ge films.** Claeson, T.; Boyce, J.B.; Geballe, T.H. (Physics Department, Chalmers University of Technology, 412 96 Gothenburg, Sweden). *Physical Review* [*Section*] *B: Condensed Matter;* **25**: No. 11, 6666-6672(1 Jun 1982).

We have studied the extended x-ray absorption fine structure (EXAFS) on the Ge K edge in Nb$_3$Ge (A15 structure) films with samples prepared by the chemical-vapor-deposition and e-beam coevaporation techniques and having different superconducting transition temperatures. For the e-beam samples, our EXAFS experiments confirm the existence of two phases, one of which is quasiamorphous with smaller atomic separations and average coordination number than the A15 phase. The additional temperature dependence of the fluctuations in the nearest- (and further)-neighbor distance agrees with expectations from the phonon spectrum determined by other methods. No effect of any lattice transformation between 77 and 573 K was obtained.

57387 **Shock compression measurements at 1 to 7 TPa.** Ragan, C.E. III. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *A: General Physics;* **25**: No. 6, 3360-3375(Jun 1982).

A shock wave generated by an underground nuclear explosion was used to perform impedance-matching experiments for several different materials at pressures from 1 to 7 TPa. The nearly planar shock passed through a 180-mm-diam by 12-mm-thick molybdenum standard and into stacks of 10-mm-thick samples of the following adjacent pairs of materials: LiD-Be, Be-LiD, Al-Mo, Pb-quartz, W-Mo (low density, rho$_0$ = 8.29 g cm^{-3}), U-Mo, and Fe. An array of 75 electrical contact pins was used to determine the shape of the shock front and the shock velocities in the standard and in the samples with uncertainties ranging from 1.5 to 2.5%. The measured shock velocity of 27.30 km/s (+- 1.5%) in the molybdenum standard corresponds to a pressure of 4.95 TPa (+- 3.5%) based on a theoretical equation of state (EOS) that includes electronic-shell-structure effects. An impedance-matching analysis was performed for each sample stack to obtain Hugoniot data for all samples except those in the U-Mo stack; neutron-induced fission heating in the uranium perturbed the initial state and produced inconclusive results. Predictions, based on the sesame EOS library, of shock velocities in most samples agree with the experimental results within the uncertainties. For the quartz and low-density molybdenum, the sesame-predicted shock velocities are too large by 5 to 10%. The following Hugoniot points in pressure (P)—particle-velocity (u) coordinates were determined for the indicated samples: LiD (P = 0.946 TPa, u = 29.39 km/s, Be (1.46, 22.69); Be (1.79, 25.42), LiD (1.038, 31.23); Al (2.23, 23.89), Mo (4.03, 16.05); Pb (4.80, 17.84), quartz (1.66, 23.64); W (6.51, 15.10), and Mo (rho$_0$ = 8.29 cm^{-3}) (3.68, 18.27). The results for iron have a larger uncertainty but are consistent with the sesame predictions.

57388 **Phason anomalies in alkali metals.** Phillips, N.E. (Department of Chemistry and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **48**: No. 21, 1504(24 May 1982). Contract W-7405-ENG-48.

A Comment on the Letter by C. D. Amarasekara and P. H. Keesom, Phys. Rev. Lett. 47, 1311 (1981).

57389 **Mechanism of near-threshold stimulated desorption of protons from transition-metal surfaces.** Melius, C.F.; Stulen, R.H.; Noell, J.O. (Sandia National Laboratories, Livermore, California 94550). *Physical Review Letters;* **48**: No. 20, 1429-1432(17 May 1982).

The mechanism for near threshold electron and photon stimulated desorption of protons from transition-metal surfaces has been investigated with use of configuration-interaction techniques on finite clusters. The calculations indicate that the protons arise from repulsive states involving double excitations from the metal-hydrogen bonding orbitals and suggest that the process may occur via a surface predissociation mechanism. The calculations are compared to experimental electron stimulated desorption results for Ni<111>.

57390 **Measurements of phonon dispersion curves, specific heats, and superconductivity in 4d niobium alloys.** Cappelletti, R.L.; Wakabayashi, N.; Kamitakahara, W.A.; Traylor, J.G.; Bevolo, A.J. (Department of Physics, Ohio University, Athens, Ohio 45701). *Physical Review* [*Section*] *B: Condensed Matter;* **25**: No. 10, 6096-6108(15 May 1982).

Inelastic neutron scattering measurements of symmetry-direction phonon dispersion curves at room temperature in two Zr-Nb alloys and in a Zr-Nb-Mo alloy are presented along with their low-temperature specific heats and superconducting transition temperatures. The phenomenological charge-fluctuation model (CFM) is used to fit the curves and to generate the phonon density of states for each sample. Moments of this distribution along with T/ sub c/ and N/sub bs/(0) are used to determine $<I^2>$ for comparison with Butler's rigid-muffin-tin calculations. Although numerical agreement is not expected and does not occur, nevertheless the general trend around Nb is reproduced. An analysis of the longitudinal-phonon contribution to λ on basis of the CFM is presented. Finally the Zr-Nb-Mo alloy is found to behave in detail like a Nb-Mo alloy of the same electron per atom ratio both in its dispersion curves and in other properties indicating the importance of this parameter.

57391 **Optical properties of liquid Pb and Bi between 0.6 and 3.7 eV.** Inagaki, T.; Arakawa, E.T.; Cathers, A.R.; Glastad, K.A. (Department of Physics, Osaka Kyoiku University, Tennoji, Osaka 543, Japan). *Physical Review* [*Section*] *B: Condensed Matter;* **25**: No. 10, 6130-6138(15 May 1982). Contract W-7405-ENG-26.

Optical properties of liquid Pb and Bi were determined at 341 and 285°C, respectively, for photon energies between 0.6 and 3.7 eV, with the use of an ultra-high-vacuum ellipsometer. It was found that liquid Pb exhibits absorption in excess of Drude absorption, with a structure strikingly similar to the interband absorption in solid Pb. The liquid-to-solid ratio of the interband intensity was found to be 0.22, and 11% of the total valence oscillator strength in the liquid was attributable to the interband transitions. Liquid Bi was also found to exhibit excess absorption at energies above 2.5 eV. These non-Drude behaviors of both liquids were found to be explained as a density-of-states effect by assuming the nondirect model for optical transitions in liquid metals.

57392 **Ab initio calculation of phonon frequencies of Al.** Lam, P.K.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **25**: No. 10, 6139-6145(15 May 1982).

We report a first-principles calculation of the phonon frequencies and mode-Grueneisen parameters of Al with the use of the atomic number and the atomic mass as the only inputs. The phonon frequencies are determined by calculating the total energy of the perfect crystal and that of the crystal distorted by a frozen phonon mode. Calculated results agree very well with experimental values. The contributions to the restoring force for various phonon modes are analyzed and discussed.

57393 **Photoemission and electron-stimulated desorption studies of H on W(110): Single- versus two-binding-site models.** Weng, S. (Physcis Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **25**: No. 10, 6188-6194(15 May 1982).

The chemisorption of H on W(110) at room temperature is studied with the use of angle-integrated photoemission and electron-stimulated desorption (ESD). The ESD cross sections of H$^+$ are found to be sol low that no significant H$^+$ signals with meaningful ion energy distributions are observed. The photoemission results show, however, two types of H adatoms, referred to as β_2 and β_1 states, for this chemisorptive system. Both states are found to appear simultaneously rather than sequentially as suggested by previous studies, and exhibit a simple 1-θ adsorption kinetics with different initial sticking coefficients. The β_2 state induces two binding energy levels at -2.0 and -6.0 eV, respectively, whereas the β_1 state induces a level at -3.8 eV. The work-function change (with a maximum value of -0.45 eV) is found to follow exactly with the intensity of the β_2 state. These results are found to be compatible with the two-binding-site model, inherently suggested by the reflection highenery electron-diffraction data. However, the results can also be consistent with a single-binding-site model suggested by a recent angle-resolved photoemission and inelastic electron scattering study. A model based on the present results is proposed and critically compared with previous studies. Unresolved problems associated with both single- and two-binding-site models are also discussed.

57394 **Addendum to the lattice dynamics of γ-Ce.** Stassis, C.; Loong, C.; McMasters, O.D.; Nicklow, R.M. (Ames Laboratory—U. S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **25**: No. 10, 6485-6487(15 May 1982). Contract W-7405-ENG-82.

Inelastic neutron scattering techniques have been used to study the temperature dependence of the dispersion curves of γ-Ce. We find that the frequencies of all but the T [111], branches exhibit normal temperature dependence. Close to the zone boundary the frequencies of the T[111] branch, on the other hand, decrease with decreasing temperature, and at room temperature this branch exhibits a dip at the zone boundary. This anomalous behavior may be related to the fcc→dhcp phase transition.

57395 **Direct correlation between angle-resolved photoemission and photon-stimulated desorption: Hydrogen on Pd{100}.** Stulen, R.H.; Felter, T.E.; Rosenberg, R.A.; Knotek, M.L.; Loubriel, G.; Parks, C.C. (Sandia National Laboratories, Livermore, California). *Physical Review [Section] B: Condensed Matter;* **25**: No. 10, 6530-6533(15 May 1982).

A direct correlation between stimulated desorption and a one-electron excitation froma particular electronic state has been demonstrated for the palladium {100} surface after hydrogen exposure. Angle-resolved photoelectron-spectroscopy measurements show a hydrogen-induced feature with intensity directly proportional to the photon-stimulated-desorption H$^+$ yield. The data may comprise the first evidence of desorption arising from direct excitation of an adsorbate-induced level.

57396 **Specific heat of well-characterized TiBe$_2$ at 0 and 7 T.** Stewart, G.R.; Smith, J.L.; Giorgi, A.L.; Fisk, Z. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **25**: No. 9, 5907-5917(1 May 1982).

The low-temperature specific heat at magnetic fields of 0 and 7 T, dc susceptibility, and resistivity data for two samples of TiBe/sub 2.00/ and one sample of TiBe/sub 1.94/O/sub 0.05/ are presented. The temperature dependence of the low temperature specific heats of all three samples of TiBe$_2$ is found to include an important T^{3}lnT term, confirming that spin fluctuations are present in TiBe$_2$, the first metal besides UAl$_2$ where such a T^{3}lnT term has been found. Evidence for a magnetic impurity present in one of the two pure TiBe$_2$ samples is inferred from the measurements and confirmed by the same measurements on the sample with oxygen intentionally added. The impurity is thought to increase the low-temperature susceptibility, shape the resistivity, and cause a 3% decrease of the low-temperature specific heat in a 7-T field at lower temperatures. At higher temperatures in the impure samples, and at all temperatures in the purer sample of TiBe$_2$, there is no change from the zero-field values in the specific heat to +- 1% in a 7-T field, in contradiction to the theoretical prediction of Beal-Monod. These field results are discussed with respect to the recent measurements of the low-temperature specific heats in a field of Pd and LuCo$_2$. Previous low-temperature specific-heat results on TiBe/sub 2.06/ and TiBe/sub 1.79/Cu/sub 0.21/ are also discussed.

57397 **Superconductivity in an Ag-Pd-Ag expitaxial metal film sandwich.** Brodsky, M.B. (Materials Science Division Argonne National Laboratory Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **25**: No. 9, 6060-6063(1 May 1982).

Superconductivity is observed in a epitaxial metal film sandwich of Ag-Pd-Ag, with T/sub c/ = 2.15 K, initially. Room-temperature storage caused T/sub c/ to drop to 1.00 K after 180 days, and the Tc decrease was accompanied by developemt of resistivity minimum. The large orbital contribution to H/sub c/2 70 kOe/K, is comparable to those found in high H/sub c/2 Chevrel-phase materials.

57398 **Weld braze technique.** Alexander, R.J.; Kanne, W.R.; Kelker, J.W. (to Department Of Energy). US Patent 4,326,117. 20 Apr 1982. Filed date 15 Apr 1975. vp.

PAT-APPL-567344.

High-strength metal joints are formed by a combined weld-braze technique. A hollow cylindrical metal member is forced into an undersized counterbore in another metal member with a suitable braze metal disposed along the bottom of the counterbore. Force and current applied to the members in an evacuated chamber results in the concurrent formation of the weld along the sides of the counterbore and a braze along the bottom of the counterbore in one continuous operation.

57399 **Superconductivity of Nb/Cu superlattices.** Banerjee, I.; Yang, Q.S.; Falco, C.M.; Schuller, I.K. (Argonne National Lab., IL (USA)). *Solid State Communications;* **41**: No. 11, 805-808(Mar 1982).

The superconducting transition temperature Tsub(c) of Nb/Cu superlattices has been investigated as a function of layer thickness. The dependence of Tsub(c) above 300 A layer thickness agrees well with proximity effect theory with no adjustable parameters. Below 300 A, the data in conjunction with current proximity theory shows that Tsub(c) of Nb decreases with layer thickness. This is interpreted as changes in the electronic density of states due to a decrease in the mean-free path.

57400 **Quenching of spin fluctuations in scandium.** Ikeda, K.; Gschneidner, K.A. Jr.; Tsang, T.W.E.; Schmidt, F.A. (Ames Lab., IA (USA); Iowa State Univ. of Science and technology, Ames (USA). Dept. of Materials Science and Engineering). *Solid State Communications;* **41**: No. 12, 889-892(Mar 1982).

The low temperature (1.3 to 20 K) heat capacity of electrotransport purified scandium metal was measured in magnetic fields up to approximately 10 T. The electronic specific heat constant, γ, decreases with increasing magnetic fields (11% at 10 T), while the coefficient to the T^3 term of the heat capacity, β, rises rapidly with increasing field and becomes almost constant at $T > 5$ T. The decrease in γ is thought to be due to the depression of spin fluctuation enhancement by the magnetic field. The increase in β is believed to be due to an induced magnetic moment on the scandium atoms caused by the applied magnetic field.

57401 **Prevention of chi and sigma phases formation in aged 16-8-2 weld metal.** Leitnaker, J.M. (Oak Ridge Natl Lab, Tenn). *Welding Journal (Miami);* **61**: No. 1, 9(Jan 1982).

Type 16-8-2 weld filler metal (16 wt-% Cr, 8 wt-% Ni, 2 wt-% Mo, nominally) is commonly used to weld Type 316 stainless steel base metal. Suitable control of composition can prevent formation of embrittling phases. The chi phase can be eliminated by adjusting the molybdenum content. The /delta/-ferrite-/sigma/ phase transformation can be prevented by suitably adjusting the carbon-plus-nitrogen content. The mechanism of this behavior is discussed. 14 refs.

57402 **Rolling of very thin sheets.** Scrutton, R.F.; Lenard, J.G. (Iowa State Univ, Ames). *Journal of Engineering Materials and Technology;* **104**: No. 1, 53-59(Jan 1982).

Thin strip specimens were reduced to foil by passing them repeatedly between the rolls of a two-high mill at low speeds. Narrow specimens were tested to avoid complications caused by roll bending. Factors governing the rate of reduction were examined, these being roll preload value and roll surface finish for low carbon strips as well as material strength, hardness, and anisotropy for aluminum and copper. No minimum thickness was found for the steel specimens; for aluminum and copper limiting thickness values were obtained based on the onset of edge cracking and longitudinal fracture. Thickness values and total number of passes were found to be inversely related. Roll surface finish and preload value affected the rate of reduction in a significant manner; hardness and developing anisotropy did not. 20 refs.

57403 **Model for the growth of hydrogen attack cavities in carbon steels.** Vagarali, S.S.; Odette, G.R. (Univ of Calif, Santa Barbara). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **12A**: No. 12, 2071-2082(Dec 1981).

Results are consistent with cavity growth by grain boundary vacancy diffusion provided the methane pressure in the cavity exceeds a threshold pressure. The threshold pressure observed decreases with an increase in temperature from 400 MPa at 658 K to 200 MPa at 723 K. The magnitude of the threshold pressure is consistent with a constrained cavity growth model in which the strain due to atom plating is accommodated by local plastic deformation around the precipitates in the boundary. 41 refs.

57404 **Vacuum consumable arc remelting electrode gap control strategies based on drop short properties.** Zanner, F.J. (Sandia Natl Lab, Albuquerque, NM). *Metallurgical Transactions, [Section] B: Process Metallurgy;* **12B**: No. 4, 721-728(Dec 1981).

The data presented are derived from four melts of JBK-75 (a modified A-286 alloy). The goal was to yield an electrode gap control strategy based on easily measured electrical parameters. At one current level and low pressure (<4*10/sup -3/ Torr), this goal was achieved, in that drop short period was correlated with electrode gap. However, this model was constrained by statistics which require counting 100 drop shorts. Other control strategies involving anode spikes, drop short resistance, and energy/resistance ratios were also evaluated and showed poor correlation with electrode gap. 8 refs.

57405 **Internal friction and Young's modulus of Nb_3Sn between 6 and 300 K.** Faucher, B.; Bussiere, J.F. (Conseil national de recherches Canada, Montreal (Canada)); Snead, C.L.; Suenaga, M. (Brookhaven National Lab., Upton, NY (USA)). *Journal de Physique (Paris), Colloque;* No. 5, 1091-1096(Oct 1981).

From 7. International conference on internal friction and ultrasonic attenuation in solids; Lausanne, Switzerland (6 - 8 Jul 1981).

Young's modulus and internal friction were measured in polycrystalline NB_3Sn between 6 and 300 K. Below the martensitic transformation temperature a large rise in internal friction is observed, in agreement with recent observations. In this temperature range, the internal friction is found to be nearly independent of frequency, a behavior consistent with stress-induced wall motion between domains of the tetragonal phase as the main source of relaxation. Internal friction peaks observed at 140 and 260 K in Nb/Nb_3Sn composite tapes are tentatively attributed respectively to an α peak in Nb and hydrogen in the Nb_3Sn layer. Annealing at 750 deg C for 1/2 h is found to decrease the transformation temperature from 49 to 40 K, and to modify the softening of Young's modulus in this temperature range. Young's modulus at 6 K is 46% of room temperature value and is unchanged by the annealing treatment.

57406 **Controlled flaw preparations for heavy-section steel fracture mechanics testing.** Holtz, P.P. *International Advances in Nondestructive Testing;* **8**: 1-53(1981).

The paper reports on a study in which cracks were grown by two techniques: a mechanical method wherein a premachined notch was sharpened by pressurization, and a method combining electron-beam welds and hydrogen charging to crack the chill zone of a rapidly placed autogenous weld. The mechanical method produces a naturally occurring growth shape controlled primarily by the shape of the machined notch; the welding-electrochemical method produces flaws of uniform depth from the surface of a wall or machined notch. Theories, details, discussions, and procedures are covered for both of the flaw-growing schemes. An appended bibliography is also provided for related program work. 56 refs.

57407 **Electrochemical corrosion testing (symposium), 1979.** Mansfeld, F.; Bertocci, U. (eds.). Philadelphia, PA; American Society of Testing Materials (1981). 411p. (CONF-790574—).

From ASTM symposium Progress in electrochemical techniques; San Francisco, CA, USA (20 May 1979).

This conference proceedings contains 24 papers, of which 2 are indexed separately. The topics discussed ranged from various aspects of localized corrosion phenomena (such as pitting, crevice corrosion, corrosion fatigue, and stress corrosion cracking) to the use of a-c impedance techniques and a number of special areas usually not discussed in detail despite their practical importance (such as atmospheric corrosion and the development of improved equipment for electrochemical corrosion studies). The session on the background and application of a-c impedance techniques permits for the first time a thorough discussion of the possibilities this approach brings to corrosion research and corrosion monitoring.

57408 **Effect of large voltage modulations on electrodes under charge-transfer control.** Bertocci, U.; Mullen, J.L. (NBS, Washington, DC). *American Society for Testing and Materials, Special Technical Publication;* No. 727, 365-380(1981). (CONF-790574—).

From ASTM symposium Progress in electrochemical techniques; San Francisco, CA, USA (20 May 1979).

The experimental test of the validity of a mathematical treatment of the effect of large a-c voltage modulations on the behavior of electrodes under charge-transfer control was carried out for the case of the hydrogen evolution reaction. A frequency analysis of the resulting current showed that both d-c and a-c components of the faradaic current were in quantitative agreement with the predictions of the mathematical model. Deviations from the calculated values, which were observed in certain conditions (particularly at higher frequencies), were explained as the effect of the ohmic-drop error. 7 refs.

57409 **Fatigue crack growth measurement and data analysis (symposium), 1979.** Hudak, S.J. Jr.; Bucci, R.J. (eds.). Philadelphia, PA; American Society of Testing Materials (1981). 370p. (CONF-7910102—).

From ASTM symposium on fatigue crack growth measurement and data analysis; Pittsburgh, PA, USA (29 Oct 1979).

The conference proceedings contains 17 papers, 4 of which are indexed separately. The articles provide information on specimen size requirements, optimum procedures for fatigue threshold and low growth rate measurements, remote crack monitoring systems, data processing procedures, statistical characterization of primary and processed data, mathematical models for data representation and interpolation, and use of fatigue crack growth information in fracture control plans.

57410 **Evaluation of polymers as lubricants in the extrusion of aluminum.** Suresh, S.; Bahadur, S. (Univ of Calif, Berkeley). *American Society of Mechanical Engineers, [Paper];* No. 81-Lub-21, 1-6(1981).

The lubricating behavior of polytetrafluroethylene, polyvinyl chloride, polychlorotrifluoroethylene, low density polyethylene, and high density polyethylene powders in the extrusion of 1100-0 aluminum has been investigated in terms of the extrusion force requirement and the quality of extrudate surface finish. Extrusion experiments which provided a measure of the extrusion force and friction force with varying ram travel were performed under both ambient and high temperature conditions. From these data the variation of coefficient of friction with ram travel and normal pressure had been calculated using the analysis based on von Mises' yield criterion and spherical velocity fields. The effect of polymer powder particle size on the extrusion force was investigated. 13 refs.

57411 **Qualification of tribological materials and coatings for use in sodium.** Johnson, R.N.; Farwick, D.G. (Hanford Eng Dev Lab, Richland, WA). pp 3.1-3.11 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

This paper describes some essential performance measures and summarizes relative properties of some of newer tribological materials qualified for use in sodium systems. Tribaloy 700 is a nickel-base hardfacing alloy that combines low friction, galling resistance, and corrosion resistance. 14 refs.

57412 **Low temperature wetting and cleanup of alkali metal-advanced electrical machine systems.** Gass, W.R.; Witkowski, R.E.; Burrow, G.C. (Westinghouse Electr Corp, Pittsburgh, Pa). pp 8.56-8.63 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Advanced homopolar electrical machines employing high electrical current density, liquid metal sliprings for current transfer utilize NaK/sub 78/ (78 w/o potassium, 22 w/o sodium) for the conducting fluid. Experiments have been performed to improve alkali metal/oxide clean-up procedures. Studies have also confirmed chemical and materials compatibility between barium doped NaK/ sub 78/ and typical machine structural materials. 4 refs.

57413 **Creep-rupture behavior of Fe-2/one quarter/Cr-1Mo steel exposed to a sodium environment.** Natesan, K.; Chopra, O.K.; Kassner, T.F. (Argonne Natl Lab, Ill). pp 19.1-19.8 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Decarburization rate constants for isothermally annealed Fe-2/one quarter/ wt% Cr-1 wt% Mo steel have been evaluated at temperatures between 482 and 593/degree/C. Uniaxial creep-rupture data have been obtained at 482, 538, and 593/degree/C in the isothermally annealed and thermally aged conditions and after exposure to flowing sodium for periods of 7.2 and 21.7 Ms. Rupture life decreases and the minimum creep rate increases as decarburization increases. 9 refs.

57414 **Influence of sodium environment on the low-cycle fatigue and creep-fatigue behavior of Fe-2/one quarter/Cr-1Mo steel.** Chopra, O.K.; Natesan, K.; Kassner, T.F. (Argonne Natl Lab, Ill). pp 19.9-19.17 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Fatigue life is a factor of 8 greater than in air and is independent of temperature in the range of 755 to 866 K. The fatigue life for thermally aged and sodium-exposed material is lower than for the isothermally annealed material. For specimens exposed to sodium for short times, the decrease in fatigue life is primarily due to aging during sodium exposure. Fatigue behavior in a sodium environment is different from that in air. 7 refs.

57415 **Comparison between ductile and brittle creep behaviour in liquid sodium.** Fidler, R.S. (CEGB, Southampton, Hamps, Engl). pp 19.18-19.25 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The lack of effect on creep on rupture behavior in a Cr1Mo is compared with Alloy 800. The contrast is attributed to different creep mechanisms. Liquid sodium aggravates brittle behavior of Alloy 800 by interaction with grain boundary creep damage. 11 refs.

57416 **Effects of sodium pre-exposure on the creep-rupture properties of type 316 stainless steel in flowing sodium.** Flagella, P.N.; Denne, J.A.; Leasure, R.A. (Westinghouse Electr Corp, Madison, Pa). pp 19.50-19.56 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

At 593/degree/C, the creep-rupture life for pre-exposed material is 50% greater than the as-received material, and the total elongation is a factor of two to three greater. The minimum creep rate (secondary) for pre-exposed material is three time greater. A portion of the change is attributed to thermal aging. 7 refs.

57417 **Stability and regeneration of low-Z coatings during elevated temperature irradiation.** Rehn, L.E.; Okamoto, P.R.; Potter, D.I.; Wiedesich, H. (Argonne National Lab., IL). *Journal of Nuclear Materials;* **85-86**: 1139-1143(Dec 1979). (CONF-790125—).

From 1. topical meeting on fusion reactor materials; Miami Beach, FL, USA (29 Jan 1979).

The formation and stability of coatings of Ni_3Si on the external surfaces of Ni-6 at. % Si specimens has been studied in situ by infrared pyrometry during irradiation at elevated temperatures. The temperature dependence of the radiation-induced growth of the coatings is shown to be dose rate dependent. The results indicate that radiation-induced segregation can be used to maintain the integrity of appropriate coatings. The design of self-healing coatings appears possible utilizing radiation-induced segregation.

57418 **Environmental cracking of the alpha-beta titanium alloy, Ti-6Al-6V-2Sn.** Rack, H.J.; Munford, J.W. (Sandia Laboratories, Albuquerque, NM). pp 284-302 of Environment-sensitive fracture of engineering materials. Warrendale, PA; Metallurgical Society of AIME (1979).

From AIME symposium on environment-sensitive fracture of engineering alloys; Chicago, IL, USA (24 Oct 1977).

The combined effects of environment, yield strength and stress state on the cracking susceptibility of beta-extruded Ti-6Al-6V-2Sn have been examined. At a constant yield strength and under plane strain conditions, the stress intensity required for slow crack propagation decreased as the severity of the environment increased, i.e., from laboratory air to 3.5% NaCl. Furthermore, the crack propagation rates were a function of both stress intensity, and environmental severity. Although the fracture toughness and threshold stress intensities for slow crack growth generally decreased with increasing yield strength, aging, which resulted in the precipitation of ordered Ti3Al particles in the primary alpha phase, tended to accentuate the susceptibility of this alloy to sustained load/stress corrosion cracking. Finally, at constant yield strength, the sustained load cracking threshold stress intensity was a function of stress state.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 56092, 56092, 56093, 56093, 56257, 56258, 56297, 56616, 57324, 57329, 57343, 58969, 58969, 58969

57419 (AERE-TP—919) **Estimation of the free energy of charge transfer in molten UO_2.** Gillan, M.J. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Dec 1981. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702346.

An estimate is presented of the free energy change associated with the charge transfer reaction $2U^{4+} \rightarrow U^{3+} + U^{5+}$ in molten UO_2, which it is argued will play an important role in determining the thermodynamic and transport properties of the melt. The calculations are based on the assumption that modification of its charge affects only the Coulomb interaction of a uranium ion with the other ions in the system, the short-range interactions being unchanged. It is shown that the required free energy may be expressed in terms of the average electric potential at the ion, which in turn depends on the radial distribution functions describing correlations with the other ions. The hypernetted chain approximation is used to calculate these radial distribution functions. This approximation is demonstrated to be accurate by testing it on an analogue charge transfer reaction in molten alkali halides, for which experimental data are available. It is found that the free energy of the reaction in molten UO_2 is about 1.7 eV lower than its value in the solid at zero temperature and probably has a value of about 0.7 eV. This implies that a substantial fraction of uranium ions in the melt are in the charge states U^{3+} and U^{5+}.

57420 (CEA-CONF—5903) **Electron radiation defects in TaCsub(1-x) and TiCsub(0.97).** Morillo, J.; de Novion, C.H.; Dural, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). Aug 1981. 15p. (CONF-810856—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701856.

From International conference on the science of hard materials; Moran, WY, USA (23 Aug 1981).

The electrical resistivity changes of TaCsub(0.99) and TaCsub(0.80) have been measured at 21 K during irradiation with electrons of incident energies ranging from 2.5 to 0.25 MeV: a nonzero production rate is observed, even at the lowest energies. The recovery of defects was followed up to 400 K for TaCsub(0.99) and TiCsub(0.97) irradiated with 2.25 MeV electrons and up to 160 K for TaCsub(0.80) irradiated with 0.75 MeV electrons. The results are compared to fast neutron radiation damage data. For TiCsub(0.97) and TaCsub(0.99), the contributions of the different defects to the production rates and recovery spectra are tentatively separated, and a rough estimate of Frenkel pair resistivities is given.

57421 (CONF-790682—8) **Sintering of polycrystalline ionic conductors: β''-Al_2O_3 and NASICON.** McEntire, B.J.; Miller, G.R.; Gordon, R.S. (Ceramatec, Inc., Salt Lake City, UT (USA)). 1979. Contract EC-78-C-01-5162. 8p. NTIS, PC A02/MF A01. Order Number DE82005492.

From 5. international conference on sintering and related phenomena; Notre Dame, IN, USA (18 Jun 1979).

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The densification kinetics for both β''-alumina and NASICON are dramatically different. β''-Alumina sinters by a reactive liquid process whereas NASICON densifies by a solid state method. More importantly, a qualitative examination of particle and agglomerate distributions, phase composition, linear shrinkage analysis, and heating rate effects can result in a concise determination of sintering processes without recourse to more quantitative techniques. Such a simple procedural method should be a basis for any beginning investigative study into the densification mechanism of new multicomponent ceramic materials.

57422 (DOE/ER/02390—T2) **Grain-boundary segregation in aluminum-doped silicon carbide.** Tajima, Y.; Kingery, W.D. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 1981. Contract AS02-76ER02390. 28p. NTIS, PC A03/MF A01. Order Number DE82015264.

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Scanning transmission electron microscopy (STEM) was used to examine sintered and hot-pressed aluminum-doped silicon carbide; grain boundary segregation of Al was observed in both materials. Semiquantitative analysis was carried out on the Al-saturated hot-pressed material. An estimated heat of segregation between 116 and 174 kJ/mol was calculated from the STEM data and equilibrium segregation theory. Strain energy as a driving force was considered negligible. The data are consistent with a segregation model in which the driving force for segregation is the difference in the nature of bonding between the solute and solvent atoms. Fast grain boundary diffusion of Al was suggested from a loss of Al during heat treatments.

57423 (DOE/ER/04679—T1) **Polarization reversal and electrocaloric measurements for field-enforced transitions in the system lead zirconate-lead titanate-lead oxide: tin oxide.** Tuttle, B.A. (Illinois Univ., Urbana (USA)). 1982. Contract AC02-78ER04679. 244p. NTIS, PC A11/MF A01. Order Number DE82019095.

Thesis. Portions of document are illegible.

The Pb(Zr, Sn, Ti)O_3 crystalline solution series (PZST) has several phases of near equal free energy, allowing field-enforceable antiferroelectric (AFE) to ferroelectric (FE) and paraelectric (PE) to ferroelectric (FE) transitions. An understanding of the stability of FE, AFE, and PE phases with respect to chemical composition, electric field and temperature was developed from low frequency polarization vs electric field measurements at different temperatures. All materials studied had a sequence of phase transitions FE-AFE-PE with increasing temperature. The temperature range of AFE phase stability increased with increasing Zr/Ti ratio, while SnO_2 content increased the stability over a wider compositional range. Thus, through compositional modification, some materials were fabricated that had an AFE temperature range of stability of only 3°C, while for others the temperature range of AFE phase stability was in excess of 100°C.

57424 (INIS-mf—7059-Vol.1, pp vp) **Electric field gradients in amorphous materials.** Czjzek, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik 1). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The observation of nuclear quadrupole interactions in amorphous solids provides a unique possibility to obtain information about the angular distribution of local ionic coordinations, complementary to the information about radial distributions derived from x-ray and neutron diffraction and from EXAFS measurements. Results of an investigation of the relation between ionic coordinations and the distribution of the nuclear splitting parameters Vsub(zz) and eta are presented. A review is given of recent experimental work primarily devoted to the problem of atomic coordination by nuclear magnetic resonance, by Moessbauer spectroscopy and by complementary methods sensitive to the distribution of crystalline electric fields.

57425 (INIS-mf—7059-Vol.1, pp vp) **Comparison of nuclear and optical methods in the study of amorphized semiconductors and insulators.** Goetz, G. (Friedrich-Schiller-Universitaet, Jena (German Democratic Republic). Sektion Physik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The damage and amorphization of implanted silicon is reported. The results of Rutherford backscattering measurements (RBS) are presented and compared with results of optical measurements and EPR investigations. At low implantation temperatures the magnitude and depth distribution of damage can be described by the energy deposited into nuclear processes. If the implantation temperature is increased the damage profiles and the type of defects are changed by annealing processes. The results for silicon are compared with those obtained for ion-implanted GaAs. For optical materials, such as $LiNbO_3$ and SiO_2 there is a pronounced difference between the results from RBS and those from optical investigations.

57426 (INIS-mf—7059-Vol.1, pp vp) **Crystallization kinetics of iron-boron metallic glasses.** Kemeny, T.; Lovas, A.; Vincze, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:; Schaafsma, A.S.; Woude, F. van der (Rijksuniversiteit Groningen (Netherlands)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The crystallization of Fesub(1-x)Bsub(x) glasses was investigated in the $12<x<26$ concentration range by Moessbauer spectroscopy and differential scanning calorimetry. The kinetics of chemical bond-Fe formation was determined from in-situ Moessbauer spectroscopy while total crystalline fraction is estimated by measuring the remaining energy of crystallization after several isothermal heat treatments of different duration. In order to support our conclusion the decomposition kinetics of the crystalline Fe_3B intermetallic compound to chemical bond-Fe and Fe_2B was also investigated. Our results indicate the presence of two separate processes and can not be explained on the basis of a eutectic mechanism in any composition ranges.

57427 (INIS-mf—7059-Vol.1, pp vp) **Crystallization of amorphous metals.** Klein, H.P.; Ghafari, M.; Ackermann, M.; Gonser, U.; Wagner, H.G. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachbereich Angewandte Physik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The crystallization temperature of amorphous metals can be enhanced by the addition of transition metals to $Fe_{80}B_{20}$. Other properties, e.g. zero magnetostriction, can then be achieved by alloying. In this paper we investigate the crystallization mechanism, the phases produced and the influence of transition metals (T) in Fesub(80-x)Tsub(x)B_{20}, using Moessbauer measurements.

57428 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer study of magnetic anisotropy and atomic short-range order in $Fe_{40}Ni_{40}P_{14}B_6$.** Melzer, K.; Hoenhe, R. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik); Wieser, E.; Matz, W. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Springmann, B. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Amorphous ribbons of $Fe_{40}Ni_{40}P_{14}B_6$ were investigated by ^{57}Fe Moessbauer spectroscopy and by a torsional-vibration magnetometer. A decrease of the magnetic anisotropy (preference of the ribbon plane) by annealing has been detected. Aspects of the atomic short-range order in the amorphous state were discussed on the basis of the field distribution functions p(H), of the crystallization behaviour and of the results from the magnetometer measurements. The short-range order changes by annealing.

57429 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer spectroscopy analysis of amorphous metallic glass Fesub(x)Nisub(1-x)$_{80}B_{20}$.** Sitek, J.; Gabris, F. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57430 (INIS-mf—7059-Vol.1, pp vp) **^{11}B NMR and magnetic susceptibility of xCuOx(1-x)($2B_2O_3xK_2O$) glasses.** Ardelean, I.; Coldea, M.; Cozar, O. (Cluj Univ. (Romania)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The temperature dependence of the magnetic susceptibility and the quadrupolar effect of xCuOx(1-x)($2B_2O_3xK_2O$) glasses ($O<=x<=20$ mol%) were investigated. Both measurements pointed out that these glasses are homogeneous up to the concentration of $x<=15$ mol%. From the Curie constants it was determined that all copper ions are in the divalent state. The quadrupolar constants increase with the CuO content and saturate above the concentration limit of homogeneous glasses.

57431 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer study of iron vanadium oxide bronze theta-Fesub(0.35)V_2O_5.** Korecki, J. (Academy of Mining and Metallurgy, Krakow (Poland). Dept. of Solid State Physics); Polaczek, A.; Pekala, M. (Warsaw Univ. (Poland)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The ^{57}Fe Moessbauer spectra of the vanadium oxide bronze theta-Fesub(0.35)V_2O_5 between 4 and 524 K reveal the ordered magnetic phase of the spin glass type below 17 K and the paramagnetic phase at higher temperatures. The two observed quadrupole doublets with nearly the same isomer shift but different ΔEsub(Ω) values are due to the Fe^{3+} ions occuring in two inequivalent surroundings. Calculations show that the lower ΔEsub(Ω) value may be ascribed to the distorted octahedral coordination of the Fe atom whereas the higher ΔEsub(Ω) value is due to the Fe atom in the adjacent site which may be randomly occupied.

57432 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer study of sputtered and liquid quenched amorphous Fesub(1-x)Bsub(x) alloys.** Korecki, J.; Stobiecki, T.; Przybylski, M. (Academy of Mining and Metallurgy, Krakow (Poland). Dept. of Solid State Physics); Stobiecki, F. (Polish Academy of Sciences, Poznan (Poland). Inst. of Molecular Physics). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Mean hyperfine fields and isomer shifts obtained from Moessbauer measurements for rf-sputtered SP and liquid-quenched LQ Fesub(1-x)Bsub(x) ($0.12<=x<=0.60$ for SP and $0.13<=x<=0.24$ for LQ) samples are compared with values for crystalline chemical bond-Fe, Fe_3B, Fe_2B and FeB. Hyperfine fields and isomer shifts for both kind of samples are in good agreement with those for the crystalline phases up to x approximately 0.35. For SP films we observe deviation from this tendency above $x>0.35$. It seems that this effect is caused by the chemical inhomogeneities of our films.

57433 (INIS-mf—7059-Vol.1, pp vp) **Magnetic hyperfine field distribution in annealed amorphous glasses.** Nistor, C.I. (Bucharest Univ. (Romania)); Spanu, V.; Mandache, S.; Filoti, G.; Florescu, V. (Institutul de Fizica si Tehnologia Materialelor, Bucharest (Romania)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57434 (INIS-mf—7059-Vol.2, pp vp) **Small-angle neutron scattering study of Fe-B and Fe-Ni-B metallic glasses.** Cser, L.; Kovacs, I.; Lovas, A.; Svab, E.; Zsigmond, G. (Koezponti Fizikai Kutato Intezet, Budapest (Hungary)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Small-angle neutron scattering (SANS) on Fe-B and Fe-Ni-B metallic glass ribbons was analysed by means of a double-crystal small-angle device and a neutron diffractometer. The sizes of magnetic domains and small clusters were determined. An appreciable anisotropy of SANS intensity and surface scattering was observed.

57435 (INIS-mf—7059-Vol.2, pp vp) **Moessbauer study of Fesub(1-x)Bsub(x) amorphous alloys: a model of the atomic structure.** Dubois, J.M.; Le Caer, G. (Centre National de la Recherche Scientifique, Nancy (France). Lab. de Metallurgie associe). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Fesub(1-x)Bsub(x) ($0.12<=x<=0.25$) glasses have been studied by Moessbauer spectroscopy. The hyperfine field distributions show that the structure of boron-rich glasses ($x>=0.20$) may be described as a packing of iron trigonal prisms centered by boron atoms. Below x=0.20, a description with mixture of such environments and of iron sites without boron neighbours is appropriate. A model based on the structural operations which generate the crystalline counterparts from close-packed structures is proposed.

57436 (INIS-mf—7059-Vol.2, pp vp) **Polarized neutron diffraction, EXAFS and Moessbauer spectroscopy studies of amorphous Cosub(1-x)Bsub(x) (x=0.185; 0.22; 0.26) alloys.** Dubois, J.M; Le Caer, G. (Centre National de la Recherche Scientifique, Nancy (France). Lab. de Metallurgie associe); Chieux, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Goulon, J. (Nancy-1 Univ., 54 (France)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

In order to collect a complete set of structural informations, polarized neutron diffraction, EXAFS and Moessbauer spectroscopy experiments have been performed in Cosub(1-x)Bsub(x) glasses. The results show that chemical short range order prevails in the amorphous structure. The boron atoms are enclosed in cobalt structural units, iron preferentially substitutes the cobalt sites which have two boron nearest neighbours. The results support the models based on the packing of structural units like tetrakaidekahedrons.

57437 (INIS-mf—7059-Vol.2, pp vp) **Coordination of iron in alumino glasses containing some alkaline or alkaline earth elements.** Eissa, N.A.; Sanad, A.M. (Al-Azhar Univ., Cairo (Egypt)); Mostafa, A.G. (Faculty of Science, Aswan (Egypt). Dept. of Physics); Hussein, A.L. (National Research Centre, Cairo (Egypt)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57438 (INIS-mf—7059-Vol.2, pp vp) **Comparison between Compton scattering and positron annihilation in Ni-B alloy glasses.** Itoh, F.; Honda, T.; Suzuki, K. (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals); Hasegawa, M. (Tohoku University, Ibaraki (Japan). Research Inst. for Iron, Steel and Other Metals). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Compton scattering and positron annihilation measurements have been carried out for four kinds of Ni-B alloy glasses. From the comparison of these two methods it is concluded that positrons in Ni-B alloy glasses are trapped at vacancy-like sites in the amorphous structure.

57439 (INIS-mf—7059-Vol.2, pp vp) **Magnetic resonances of borate glasses doped with paramagnetic ions.** Nicula, A.; Simon, S. (Cluj Univ. (Romania)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Results obtained by means of magnetic resonance (NMR and EPR) techniques on the structural modifications induced in alkali borate glasses by the preparation temperature are presented, with particular reference to alkali borate glasses containing paramagnetic ions (V^{4+}, Mn^{2+}, Cu^{2+}) whose EPR spectra exhibit hyperfine structure due to interactions with their nuclei. In this context the EPR technique may be regarded as an indirect nuclear method for the investigation of structure.

57440 (INIS-mf—7059-Vol.2, pp vp) **Moessbauer study of the amorphous tin-oxide system.** Pasternak, M. (Tel Aviv Univ. (Israel)); Benczer-Koller, N. (Rutgers--the State Univ., New Brunswick, NJ (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57441 (INIS-mf—7059-Vol.2, pp vp) **Structural properties of sputter-deposited iron-garnets from Moessbauer-spectroscopy.** Schultes, N.; Schieder, H.; Litterst, J.; Kalvius, G.M. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fachbereich Physik). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Samples of non-crystalline (nc) iron garnets (RIG, R=Sm, Gd, Tm, Eu, Dy) and of stoichiometric mixtures of nc R_2O_3 and nc Fe_2O_3 have been prepared by dc-sputtering (Ar, 10 kV, 2 10^{-4} Torr Ar^+), using the polycrystalline material as targets and a mylar foil as substrate (77 K). The samples were studied by Moessbauer spectroscopy between 4.2 K and 300 K. In the paramagnetic state (above T approximately 60 K) the ^{57}Fe hyperfine (hf) spectra can be interpreted by a superposition of three quadrupole patterns, reflecting different iron sites. These are assigned to Fe^{2+} and tetrahedrally and octahedrally coordinated Fe^{3+}. The quadrupole interactions reveal Gaussian distributions ($\sigma\Xi$ approximately 0.4). The appearence of divalent iron is discussed in view of possible oxygen defiency and the presence of tetravalent impurity cations.

57442 (INIS-mf—7059-Vol.2, pp vp) **Effect of the composition and processing parameters on the physical properties of amorphous electroless Nisub(1-x)Psub(x) alloys.** Schmidt, T. (Csepel Vas es Femmuevek, Budapest (Hungary)); Varga, L. (Institute for Welding and Material Testing, Timisoara (Romania)); Kemeny, T.; Konczos, G.; Tompa, K.; Kajcsos, Zs. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

In order to find the most suitable samples for detailed physical investigations, Ni-P samples were prepared by chemical deposition with different processing parameters. The composition dependence of the density and the positron annihilation characteristics are reported. The second moment of inhomogeneously and homogeneously broadened ^{31}P NMR lineshape was used to characterize the local magnetic field inhomogeneities as a function of P content. The significance of processing parameters are discussed in terms of differential scanning calorimetry data.

57443 (INIS-mf—7095, pp vp) **Vibratory compaction of brittle materials (UO_2 as example).** Steinkopff, H.; Krompass, R.; Rudolph, K.; Herbig, R. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57444 (INIS-mf—7095, pp vp) **X-ray structure investigation of ground tungsten carbide samples with chromium and nickel additions.** Sedivy, J.; Sichova, H. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni); Grha, Z. (Forschungsinstitut fuer die Pulvermetallurgie, Sumperk (Czechoslovakia)). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57445 (INIS-mf—7095, pp vp) **Influence of structural parameters on the fracture toughness of sintered carbides WC-Co.** Dusza, J.; Pelikan, K. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Metalurgie). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57446 (INIS-mf—7095, pp vp) **Subcritical crack growth in WC-Co alloys.** Majstrenko, A.L. (AN Ukrainskoj SSR, Kiev. Inst. Sverkhtverdykh Materialov); Edelman, J.; Gille, G. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. (In Russian). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57447 (INIS-mf—7095, pp vp) **Investigation on formation and decomposition of the γ-phase in the WC-TiC-TaC-NbC-Co type cemented carbides.** Bujok, J.; Bukowiecki, J.; Karwata, T. (Huta Baildon, Katowice (Poland)). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57448 (INIS-mf—7095, pp vp) **Changing of the wear behaviour of cemented tungsten carbide by ion implantation.** Dienel, G.; Hohmuth, K. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57449 (INIS-mf—7095, pp vp) **Molybdenum-based refractory compounds and cemented carbides.** Holleck, H.; Prakash, L.; Thuemmler, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57450 (INIS-mf—7095, pp vp) **Investigations of hard metals based on (Mo,W)C mixed crystals.** Komac, M.; Novak, S. (Ljubljana Univ. (Yugoslavia)). 1981. (In German). NTIS (US Sales Only), PC A09/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

57451 (INIS-mf—7096, pp vp) **Structure and properties on hard alloys in the Ti-C-B system.** Sinel'nikova, V.S.; Chernysheva, O.F.; Kosolapova, T.Ya.; Smirnov, V.P. (AN Ukrainskoj SSR, Kiev. Inst. Problem Materialovedeniya). 1981. (In Russian). NTIS (US Sales Only), PC A13/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

With the aid of optical and electron microscopy we have investigated the structure of TiB_2 films deposited from the gaseous phase. It is shown that, depending on the coating parameters used, layers can be obtained with either dense, fine-grained or loose needle- or plate-like structures. (author).

57452 (INIS-mf—7096, pp vp) **Relation between structural parameters and mechanical properties of heat-treated WC-Co alloys.** Novikov, N.V.; Gorodyskij, N.I.; Loshak, M.G.; Aleksandrova, L.I. (AN Ukrainskoj SSR, Kiev. Inst. Sverkhtverdykh Materialov). 1981. (In Russian). NTIS (US Sales Only), PC A13/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

We have quenched hard alloys from temperatures above 1,300 K. Such a thermal treatment enhances both strength and workability. On the one hand, this can be attributed to an increased content of solute tungsten and carbon in cobalt after thermal treatment which improves the strength of the matrix. On the other hand, this process reduces the number Nsub(k) of contact points and the contact percentage Csub(WC-WC) of adjacent carbide grains which enhances the workability. (author).

57453 (INIS-mf—7097, pp vp) **Investigation of the structural influence on the strength behaviour of TiC-Ni-Mo hard alloys.** Pilyankevich, A.N.; Shapoval, T.A.; Paderno, V.N.; Verkhovodov, P.A.; Vitryanyuk, V.K. (AN Ukrainskoj SSR, Kiev. Inst. Problem Materialovedeniya). 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

The microstructure and fracture area of TiC-based hard alloys with nickel-molybdenum binder, in particular of TN-20, has been investigated with the aid of electron microscopy. It is shown that an analysis of the structure and of the behaviour of its constituents during fracture enables an assessment of the production process, of the strength and physical properties of the compact as well as of its usability under actual conditions of use. (author).

57454 (INIS-mf—7097, pp vp) **Comparable investigations of wear and mechanical behaviour of (Ti,Mo)C-Ni and WC-Co cemented carbides.** Beger, A.; Faehrmann, M.; Gille, G.; Kotsch, H.; Mueller, K. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). 1981. (In German). NTIS (US Sales Only), PC A15/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

For both cemented carbide types hardness and fracture toughness or bending fracture strength have reciprocal dependencies on structural variations. The higher hardness of TiC-cemented carbides is connected with lower Ksub(Ic)- and threshold values Ksub(TH) for fatigue. Opposite to WC-Co alloys (Ti,Mo)-Ni-alloys show no stable creep up to 1300 °C, the deformation behaviour is brittle up to this temperature regime. This correlates with the stronger dependence of wear on cutting speed and feed. (author).

57455 (INIS-mf—7097, pp vp) **Liquid phase sintered Fe-Mo-C-materials.** Drozda, W.; Jangg, G. (Technische Univ., Vienna (Austria)). 1981. (In German). NTIS (US Sales Only), PC A15/MF A01.

From 7. international conference on powder metallurgy; Dresden, German Democratic Republic (22 Sep 1981).

Fe-Mo-C-parts possessing good hardening and annealing behaviour as well as interesting magnetic properties can be produced by liquid-phase sintering of Fe- and Mo-powder mixtures with graphite. With a composition of 2 wt. % Mo and 1.5 wt. % C undistorted samples are obtained despite high shrinkage at sintering temperatures of 1310 °C. By quenching them from 900 °C a hardness near 800 and Hc-values of 56 A/cm were achieved. (author).

57456 **(SAND—81-2454C) Thick boride coatings by chemical vapor deposition.** Pierson, H.O.; Mullendore, A.W. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 13p. (CONF-820412—4). NTIS, PC A02/MF A01. Order Number DE82015412.

From Metallurgical coatings and process technology conference; San Diego, CA, USA (4 Apr 1982).

This paper describes an experimental study of the chemical vapor deposition (CVD) of TiB_2 by the hydrogen reduction of $TiCl_4$ and BCl_3 with the purpose of obtaining very thick(>100 μm) and uniform coatings. The optimum deposition conditions were: temperature: 900 to 950°, source gas ratios: $Ti/B = 1/2$ and $H/Cl = 6/1$. With these conditions, deposition rates greater than 25 μm/hour were obtained. Composition was very uniform with excess boron over stoichiometry (probably in the form of free boron). A small amount of chlorine remained incorporated in the deposit probably as $TiCl_2$ (0.05 w/o at. 950°C). The coatings were very hard (approx. 3700 kg/mm^2) and hardness was uniform through the thickness. With careful control of the deposition parameters, the CVD of uniform coatings with thickness $>$ 1 mm appears feasible. 3 figures, 2 tables.

57457 **Diffusion of ion implanted aluminum in silicon carbide.** Tajima, Y.; Kijima, K.; Kingery, W.D. (Ceramics Division, Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Journal of Chemical Physics;* **77**: No. 5, 2592-2598(1 Sep 1982).

Diffusion of aluminum in silicon carbide was studied by Al implantation into single crystal SiC and subsequent profile analyses by secondary ion mass spectrometry (SIMS). The bulk diffusion coefficient of Al at temperatures between 1350 and 1800 °C was determined to be $D(cm^2/s) = 1.3 \times 10^{-8}$ exp (-231 kJ/mol/RT). The results were characterized by a low activation energy and a low pre-exponential constant compared with previously reported results. Dislocation enhanced diffusion was suggested from the appearance of the tails observed in the annealed concentration profiles.

57458 **Distribution of hydrogen vibrations in LaHsub(2.28) and LaHsub(2.99).** Kamitakahara, W.A. (Ames Lab., IA (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics); Crawford, R.K. (Argonne National Lab., IL (USA)). *Solid State Communications;* **41**: No. 11, 843-847(Mar 1982).

The hydrogen vibrational modes in LaHsub(x) samples have been investigated by pulsed neutron spectroscopy. The results are compared with a simple model emphasizing strong H-H forces and the lack of stoichiometry in $LaH_{2.28}$.

57459 **Diffusion of ^{51}Cr in Cr-doped MgO.** Weber, G.W.; Bitler, W.R.; Stubican, V.S. (Pa State Univ, University Park). *Journal of Physics and Chemistry of Solids;* **41**: No. 12, 1355-1359(1980).

An arc fusion technique was used to grow single crystals of MgO and Cr-doped MgO. Diffusion coefficients for /sup 51/Cr in Cr-doped single crystals were measured at three temperatures 1383, 1444 and 1495/degree/C using a high specific activity isotope /sup 51/Cr. An approximately linear relationship between the concentration of Cr-ions in MgO and diffusion coefficients of /sup 51/Cr was obtained. It is shown that the activation energy of 19.6 kcal/mole obtained for the doped crystals is the difference between the energy for motion and the energy for association of the Cr-vacancy complexes. Using a previously determined value of 39.9 kcal/mol for the energy of motion, the energy of association for the Cr-vacancy complex is calculated to 20.3/plus or minus/3 kcal/mol or 0.88/plus or minus/0.13 ev. 14 refs.

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REFER ALSO TO CITATION(S) 56663, 56664, 57464, 58962

57460 **(IPPJ-AM—18) Data on the backscattering coefficients of light ions from solids.** Tabata, T.; Ito, R.; Itikawa, Y. (Nagoya Univ. (Japan)). Oct 1981. 118p. NTIS, PC A06/MF A01.

Data on the backscattering of H, D and He ions from solids were collected. The following parameters are considered: number backscattering coefficient energy backscattering coefficient, and the mean fractional energy of backscattered particles. Most of the data range in the region of incident energy from 1 to 50 keV. The empirical formulas, obtained from the Monte Carlo results for energies below 1 keV are plotted for energies from 10 eV to 100 keV. The rms deviations of the data from the empirical formulas are between 6 and 30 percent.

57461 **(JINR—R-17-81-400) Scaling laws, logarithmic corrections and inner field.** Plechko, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701858.

The role of the inner molecular field in the system near critical point in the ordered phase is discussed on the phenomenological level. Relations for the indices of the logarithmic corrections to the power singularities, analogous to the scaling laws for the power indices, are represented.

57462 **Specific heat of superconductor—normal metal composites.** Goodrich, L.F.; Verhoeven, J.D.; Finnemore, D.K. (Ames Laboratory: USDOE and Departments of Physics and Materials Sciences and Engineering, Iowa State University, Ames, Iowa). *Journal of Low Temperature Physics;* **47**: No. 5, 451-460(1 Jun 1982). Contract W-7405-ENG-82.

The specific heat of Th—Nb composites has been measured to determine the extent to which a dense array Nb rods will enhance the superconducting energy gap of the surrounding Th matrix at temperatures well below T/sub c/ of the Th. A directional solidification technique has been used to prepare an acicular composite having a triangular array of 500-nm-diameter Nb rods in a Th matrix with a center-to-center spacing of 1500 nm. At low temperatures, where both metals are superconducting, the specific heat indicates that the Th matrix has an energy gap about 10% larger than bulk Th, so there is clear evidence of an induced energy gap in the Th, but as yet there is no theory for the specific heat in this regime. A field as small as 20 mT will quench all evidence of proximity-induced superconductivity in the Th, indicating a strong field dependence of the Cooper pair decay length K/sub N/^{01}.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 56190, 56613, 56662, 56662, 56663, 57688, 57689, 57703, 57745

57463 **(AD-A—109385/5) Weathering of plastics materials in the tropics. 6. The further evaluation of a solar radiation concentrating device (EMMA) as a means of accelerating the weathering of plastics.** (Propellants Explosives and Rocket Motor Establishment, Waltham Abbey (UK)). 1981. 42p. NTIS, PC A03/MF A01.

This report is an account of a second trial conducted at Desert Sunshine Exposure Test Inc. using the facility of the EMMA and EMMAQUA machines which are reported to accelerate natural weathering. Low density polyethylene and polyacetal specimens were tested and no real acceleration factors could be found for the EMMA machines over natural 45 deg exposure.

57464 **(AD-A—111393/5) Properties of blends of polyphenylsulfone and acetylene terminated reactive plasticizer. Final report Oct 79-Jun 80.** Sikka, S.S.; Goldfarb, I.J. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA)). Nov 1981. 44p. (AFWAL-TR—81-4100). NTIS, PC A03/MF A01.

Polyblends of polyphenylsulfone (PPS) and reactive plasticizer (acetylene terminated sulfone) have been considered as matrix resins for graphite reinforced composites. The thermoplastic polyphenylsulfone provides high glass transition temperature and therefore high end-use temperature while the reactive plasticizer-acetylene terminated sulfone (ATS) lowers the glass transition temperatures and the viscosities of the blends for the purpose of improved processing conditions. Since ATS contains reactive acetylene functional groups, it reacts and becomes dormant in the system. Blends of polyphenylsulfone and reactive plasticizer have been prepared in weight percent compositions of 90 PPS/10 ATS, 80 PPS/20 ATS, 70 PPS/30 ATS, and 60 PPS/40 ATS. These were cast from chloroform solvent yielding clear films. The calculated and measured refractive indices of PPS/ATS are about the same and therefore light scattering studies of polyblends have not shown any phase separation of PPS and ATS. Transmission electron microscopy on microtomed specimens of PPS/ATS blends indicates a possibility of phase-separation of the the two components but it needs further investigation. Cure studies of these blends have shown retention of about 14% solvent which has additional influence in lowering the Tg of the blends.

57465 **(CEA-N—2236) Irradiation and doping effects on polyacetylene (CH)sub(x).** Mermilliod-Thevenin, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium; Strasbourg-1 Univ., 67 (France)). Nov 1981. 64p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702336.

Thesis.

Insulating when pure, the polyacetylene (CH)sub(x) becomes metallic when doped. Irradiation and n (sodium) or p (iodine) doping effects have been studied by swelling, thermal and electrical conductivity and by specific heat measurements. The swelling of the sample when doped has been found to be proportional to the size and to the concentration of the impurity. Within the experimental error, the specific heat is independent of the iodine concentration (in the range 0-4%) and varies linearly with temperature from 20 K to 300 K. The thermal conductivity (75 $mW.cm^{-1}.K^{-1}$ at 300 K) decreases continuously with temperature and increases significantly with a 4% iodine concentration. As the compound is metallic, this new contribution has been attributed to the charge carriers. The iodine doped samples are not thermally stable, even at room temperature: their resistivity increases. This thermolysis is activated by X-ray irradiation. But the X-ray efficiency decreases drastically by lowering the temperature (0 deg C). At 20 K, 10^{-3} defects, induced by a neutron irradiation cause the same decrease in the conductivity as the loss of 4-5% of iodine does.

57466 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer studies of crystallization, glass transition and structural relaxation in non-metallic amorphous materials.** Litterst, F.J. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet Physik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The application of the Moessbauer effect for the investigation of structural re-arrangement processes in non-metallic amorphous materials is discussed on selected examples. In this review some studies of glass and secondary transitions in polymers and recrystallization experiements in glasses and vapour-quenched noncrystalline materials are presented using the 14.4 keV resonance of ^{57}Fe. Special emphasis is given to studies of structural dynamics.

57467 (INIS-mf—7059-Vol.1, pp vp) **Magnetic relaxation properties and clustering of iron ions in polymers and glasses.** Suzdalev, I.P.; Imshennik, V.K. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki:. 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Information on the relaxation Moessbauer experiments on polymers and glasses is summarized. Special attention is devoted to the heterogeneous distribution of iron atoms in host matrices. Three types of iron clusters are discussed: clusters containing a few but definite number of metal ions, clusters consisting of small grains in a host matrix, and regions in non-crystalline material which contain an enriched zone of metal ions. They have been studied by Moessbauer spectroscopy.

57468 (INIS-mf—7059-Vol.1, pp vp) **Investigations on the phase transitions and temperature behaviour of PTFE by the positron lifetime technique.** Breitenhuber, L.; Kindl, P.; Sormann, H.; Puff, W. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Positron lifetime spectra of the semicrystalline polymer material, Polytetrafluoroethylene (PTFE) with high amorphous content are measured from -190 deg C to 420 deg C and are decomposed into four annihilation terms. The four positron lifetimes and intensities reflect, apart from their density-caused temperature dependence, the structural changes of the polymer at the first and second order transitions. Above 100 deg C a secondary crystallization can be clearly observed.

57469 **(SAND—82-1259) Electrical conductivity of rigid polyurethane foam at high temperature.** Johnson, R.T. Jr. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1982. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01. Order Number DE82020468.

The electrical conductivity of rigid polyurethane foam, used for electronic encapsulation, has been measured during thermal decomposition to 340°C. The conductivity below ~ 150°C is $< 10^{-13}$ (ohm-cm)$^{-1}$ but increases dramatically to ~ 10^{-9} (ohm-cm)$^{-1}$ as the temperature is increased to 260 to 270°C. At higher temperatures the conductance continues to increase, but some of this increase is due to sample softening and changes in sample geometry. With pressure-loaded electrical leads, sample softening results in eventual contact between electrodes (at ~ 340°C) producing electrical shorting. Experiments in air and nitrogen environments showed no significant dependence of the conductivity on the atmosphere over the temperature range examined. The insulating characteristics of polyurethane foam below ~ 270°C are similar to those for silicone-based (glass-fabric reinforcing) materials used for electronic case (or support structure) housings and are better than those for phenolics (glass-fabric reinforced). At higher temperatures (≧ 270°C) the phenolics appear to be better insulators (combined physical and electrical characteristics) to ~ 500°C and the silicones to ~ 600°C. The Sylgard 184/GMB encapsulant is a significantly better insulator at high temperature than the rigid polyurethane foam.

57470 **(UCRL—87584) Commercial synthesis of M97KVB gum, a precursor to cellular silicone cushions. Part I.** Riley, M.O.; Kolb, J.R.; Jessop, E.S. (Lawrence Livermore National Lab., CA (USA)). 14 May 1982. Contract W-7405-ENG-48. 22p. (CONF-820642—1). NTIS, PC A02/MF A01. Order Number DE82015191.

From JOWOG-28 meeting; Kansas City, MO, USA (10 Jun 1982).

The technology for producing an LLNL-developed polymer, L97KVB, has been transferred to a commercial speciality silicones manufacturer, McGhan-NuSil Corporation. Workers there have demonstrated both on a small scale and on a 200 lb. scale that they can produce a polymer which meets our analytical specifications and which will also perform satisfactorily in our load deflection and compression set tests.

57471 **Metal-doped organic foam.** Rinde, J.A. (to Dept. of Energy). US Patent 4,325,737. 20 Apr 1982. Filed date 16 Oct 1980. vp.

PAT-APPL-197465.

Organic foams having a low density and very small cell size and method for producing same in either a metal-loaded or unloaded (Nonmetal loaded) form are described. Metal-doped foams are produced by soaking a polymer gel in an aqueous solution of desired metal salt, soaking the gel successively in a solvent series of decreasing polarity to remove water from the gel and replace it with a solvent of lower polarity with each successive solvent in the series being miscible with the solvents on each side and being saturated with the desired metal salt, and removing the last of the solvents from the gel to produce the desired metal-doped foam having desired density cell size, and metal loading. The unloaded or metal-doped foams can be utilized in a variety of applications requiring low density, small cell size foam. For example, rubidium-doped foam made in accordance with the invention has utility in special applications, such as in x-ray lasers.

3606 Other Materials

REFER ALSO TO CITATION(S) 56308, 56308, 56309, 56326, 56370, 56371, 56372, 56387, 56388, 56389, 56389, 56483, 56532, 56533, 56607, 56908, 56908, 56991, 57001, 57387, 57466, 57467, 57764, 58747, 58749

57472 **(AD-A—111149/1) Effects of radiation on oxide materials. Final report 26 Sep 77-25 Sep 78.** Hughes, G.W.; Thomas, J.H. III. (RCA Labs., Princeton, NJ (USA)). Nov 1981. 91p. (PRRL—79-CR-12). NTIS, PC A05/MF A01.

Dry and wet (pyrogenic steam)-grown thermal oxides on (100) silicon were made for an investigation of the radiation sensitivity of MOS devices. Oxides were grown under conditions known to produce state-of-the-art hardened oxides as well as very soft oxides. MOS capacitors were fabricated with thin semi-transparent and thick aluminum gates for irradiation with 10.2-eV vacuum ultraviolet (VUV) photons and 1-MeV electrons, respectively. Electrical measurements were made on MOS capacitors to determine trapped-charge density, charge transport, and thermal-trap depth, using high frequency and quasi-static CV, triangular voltage sweep (TVS), and thermally stimulated current (TSC) techniques. TSC measurements taken on irradiated capacitors to characterize the thermal-energy trap spectra gave varied results. Analytical measurements of interface stoichiometry and impurity profiles were done by the use of ion-scattering spectroscopy (ISS), x-ray photoelectron spectroscopy (XPS), and secondary-ion mass spectroscopy (SIMS).

57473 (BDX—613-2798) **Coefficient of thermal expansion of fluorinert as a function of volume percent absorbed air.** Reilly, J.M. (Bendix Corp., Kansas City, MO (USA)). Jun 1982. Contract AC04-76DP00613. 16p. NTIS, PC A02/MF A01. Order Number DE82016998.

The relationship between the coefficient of volumetric thermal expansion of liquid Fluorinert FC-86 and the volume percent of absorbed air was examined experimentally. A special test apparatus was built for this purpose. A floating liquid seal was used to isolate the Fluorinert sample from the atmosphere. This prevented gas absorption during thermal cycling yet allowed the sample to expand and contract freely during testing. It was found that the coefficient of thermal expansion is not influenced by the percentage of absorbed air.

57474 (BNL—31682) **Neutron-scattering study of Cs_2CoCl_4: a system of 1D, S = 1/2 XY antiferromagnetic chains with spin frustration.** Hirakawa, H.; Yoshizawa, H.; Shirane, G.; Shiba, H. (Brookhaven National Lab., Upton, NY (USA); Tokyo Univ. (Japan). Inst. for Solid State Physics). 1982. Contract AC02-76CH00016. 8p. (CONF-820929—3). NTIS, PC A02/MF A01. Order Number DE82019994.

From ICM conference; Kyoto, Japan (6 Sep 1982).

Evidence for the existence of one-dimensional XY antiferromagnetic chains in Cs_2CoCl_4 has been given by the neutron scattering measurements. This compound also provides a simple model of order in the frustrated system.

57475 (CEA-CONF—5916) **Chevrel phases, actinide based compounds $An(1+x)Mo_6Se_8$ (An=Np, Pu, Am).** Damien, D.; de Novion, C.H.; Gal, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). Sep 1981. 13p. (In French). (CONF-810948—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701969.

From Actinides-1981 conference; Pacific Grove, CA, USA (10 Sep 1981).

Chevrel's phases are ternary chalcogenides of molybdenum of the general formula M Mo_6Se_8 where M represents a monovalent cation (Na^+, Li^+), divalent (Pb^{2+}, Mg^2), trivalent (TR^{3+}) or even tetravalent cation (Th^{4+}). The rare earth based compounds are of particular interest because the selenides are superconductors with high critical temperature and particularly with very important critical field. The ternary selenides $An(1+x)Mo_6Se_8$ with x=0 and 0.2 and An=^{237}Np, ^{239}Pu, ^{241}Am were prepared and studied. These compounds are isomorphous of their rare earth counterparts and crystallize in a rhombohedral system. Their idealized structure is formed of Mo_6Se_8 clusters around the actinide ions. The An cations are surrounded with 8 selenium ions in a quasi cubic symmetry. The magnetic susceptibilities of the compounds, measured between 2.5 and 300 K show that the actinides are trivalent, thereby agreeing with the value of their lattice parameters. The self-irradiaton effects with the Pu 239 and particularly the Am 241 are sufficient to destroy the superconductivity.

57476 (DOE/ER/01198—1386) **Band mapping of semiconductors with photoemission.** Chiang, T.C. (Illinois Univ., Urbana (USA)). Jul 1982. Contract AC02-76ER01198. 2p. (CONF-820934—1). NTIS, PC A02/MF A01. Order Number DE82019387.

From Conference on semiconductors in the vacuum UV: applications of synchrotron radiation; West Berlin, F.R. Germany (13 Sep 1982).

Using angle-resolved photoemission techniques, energy band dispersion relations of solids can be determined directly. Results on cleaved GaAs (110) and GaSb (110) surfaces are presented and briefly discussed. (WHK)

57477 **(INIS-mf—7043) Ceramic solid electrolytes. 8th seminar.** (Vyzkumny Ustav Elektrotechnicke Keramiky, Hradec Kralove (Czechoslovakia)). 1980. 6p. (In Czech). (CONF-8004216—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82780687.

From 8. seminar on ceramic solid electrolytes; Hradec Kralove, Czechoslovakia (14 Apr 1980).

A separate abstract was prepared for each paper in scope for the Energy Data Base. (HDR)

57478 (INIS-mf—7059-Vol.1, pp vp) **NMR studies of the structure of non-metallic glasses.** Bray, P.J.; Bucholtz, F.; Geissberger, A.E.; Harris, I.A. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Boron-11 NMR spectroscopy has been used to determine the fractions of borons in $BO_4(N_4)$ and $BO_3(N_3)$ configurations, and the fractions of BO_3 units having all bridging (Nsub(3S)) and one or more non-bridging (Nsub(3A)) oxygens. Iron lead borate glasses containing up to 15.3 Mol% Fe_2O_3 are found to have the iron ions distributed uniformly throughout the glasses, and the iron oxide influences the borate network only up to 4.64 Mol% Fe_2O_3. The high sensitivity of boron-10 NMR spectra to structural details has premitted identification in glasses of structural groupings and quantitative determination of the amount of each unit. Oxygen-17 NMR spectra for vitreous B_2O_2 and SiO_2 yield bonding and structural information confirm models for these glasses. Silicon-29 NMR spectra for glasses in the system K_2O-SiO_2 show agreement with the spectra for the crystalline compounds.

57479 (INIS-mf—7059-Vol.1, pp vp) **Amorphisation of solids by ion implantation.** Carter, G.; Grant, W.A. (Salford Univ. (UK). Dept. of Electrical Engineering). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The nature and extent of the phase change by ion implantation depends upon the implant species, energy, substrate material, crystallography and temperature. If the rate of energy deposition density by an individual projectile is of the order or larger than, e.g., the atomic heat of melting, dynamic amorphisation of a local volume of the solid occurs which may subsequently reorder into a partly recrystallised region under thermal, chemical and stress relaxation driving forces, but, alternatively, the zone may remain amorphised. Under low energy deposition density conditions any amorphisation which occurs is the result of collective impact processes. Experimental evidence for these processes is discussed and physical and mathematical models are summarised.

57480 (INIS-mf—7059-Vol.1, pp vp) **Moessbauer spectroscopy studies of amorphous Fesub(x)Bsub(100-x) (0<x<=90).** Chia-Ling Chien; Unruh, K.M. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Magnetic ordering temperatures and hyperfine spectra at 4.2 K have been measured for amorphous Fesub(x)Bsub(100-x) (0<x<=90) produced by sputtering. Magnetic ordering occurs at a percolation-line threshold of xsub(c) approximately equal to 38, above which Tsub(c) rises sharply with the Fe content. Tsub(c) reaches a maximum at x approximately equal to 70 and decreases at the Fe-rich side. The average Fe hyperfine field increases monotonically with the Fe content. It is shown that the hyperfine field distributions of samples with x<70 cannot be accounted for by the "quasi-crystalline" model proposed by Vincze et al.

57481 (INIS-mf—7059-Vol.1, pp vp) **Distribution of the ligand field at the Fe^{2+} ion in frozen aqueous solutions of $Fe(ClO_4)_2$.** Nagy, D.L.; Horvath, D.; Szuecs, I.S. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:; Ritter, G.; Volland, U. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.)); Spiering, H. (Johannes Gutenberg Univ., Mainz (German F.R.)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Moessbauer spectra of eutectic frozen aqueous solutions of $Fe(ClO_4)_2$ have been measured at 4.2 K in applied longitudinal magnetic fields up to 5 T. The spectra are interpreted in terms of a model accounting for the random distribution of the ligand field at the Fe^{2+} ion owing to the amorphity of the environment. The equilibrium state of the $Fe(H_2O)_6{}^{2+}$ complex is determined by a static Jahn-Teller calculation. The main features of all spectra can be well reproduced by choosing Esub(JT)(tau)=140 cm^{-1} and ωsub(tau)=150 cm^{-1}.

57482 (INIS-mf—7059-Vol.1, pp vp) **Hyperfine field, concentration and magnetic anisotropy distributions in amorphous CoB, CoP alloys, a NMR study.** Panissod, P.; Qachaou, A.; Durand, J. (LMSES, Strasbourg (France)); Hasegawa, R. (Allied Chemical Corp., Morristown, NJ (USA)). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The ^{59}Co NMR spectra in rapidly quenched CoB and electrodeposited CoP amorphous alloys exhibit structures which were found to be very sensitive to the excitation RF field strength. The study of this effect shows that there exists a domain wall mobility distribution in these samples which is closely related to concentration fluctuations. The density of "structural defects" that pin the dws is highest in regions where the average concentration is close to the eutectic composition, while dws move more freely in regions where the average concentration is higher or lower than this composition. Regions of eutectic composition are tentatively identified as zones of highest perpendicular easy axis anisotropy. The particular role of eutectic composition is emphasized by the concentration dependence of the NMR signal intensity and the effect of annealing treatment; a phase separation is suggested for that composition.

57483 (INIS-mf—7059-Vol.1, pp vp) **^{31}P NMR measurements on dilute Ni-P based amorphous alloys.** Varga, L.; Tompa, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:. 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Ni_{75}-TM_5-P_{20} dilute alloys (TM: transition metal) were investigated by ^{31}P NMR spectroscopy. The Knight shift and the second moment of the NMR line and the longitudinal relaxation time were measured for TM=Cu, Fe, Co, Mn, Cr, V by c.w. and pulsed NMR techniques. The influence of the 3d alloying element on the electronic structure of amorphous metal has been discussed.

57484 (INIS-mf—7059-Vol.2, pp vp) **Amorphous and microcrystalline materials in archaeology.** Takacs-Biro, K. (Magyar Allami Foeldtani Intezet, Budapest (Hungary)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Potentials of nuclear testing methods applied to archaeological research and the resulting historical implications are discussed. Special attention is given to certain rock materials which play important role in the earliest human activities and to natural and artificial glass materials and glaze utilized or produced by man. In the summary of the results on the archaeometrical examination of amorphous and microcrystalline materials in Hungary, non-nuclear analyses are also included.

57485 (INIS-mf—7059-Vol.2, pp vp) **Moessbauer and infra-red spectra of some alkaline earths phosphate and borate glasses.** Eissa, N.A.; Shaisha, E.E.; Bahgat, A.A. (Al-Azhar Univ., Cairo (Egypt)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

57486 (INIS-mf—7059-Vol.2, pp vp) **Negative pion - a new nuclear probe in material research.** Horvath, D. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics); Petrukhin, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The formation and decay of pionic hydrogen atoms are discussed, with special emphasis on the information available from pion capture measurements concerning the physico-chemical environment of hydrogen atoms in complex systems.

57487 (INIS-mf—7059-Vol.2, pp vp) **Positron annihilation study of mechanochemical reaction between Zn+Se and Zn+S.** Kajcsos, Zs.; Horvath, D. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:; Marczis, L. (Vasipari Kutato Intezet, Budapest (Hungary)); Tshakarov, C.G.; Gospodinov, G.G. (Vissh Khimiko-Tekhnologicheski Inst., Burgas (Bulgaria)); Vertes, A. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary). Fizikai Kemiai es Radiologiai Tanszek). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Positron lifetime spectra were recorded and evaluated in mixtures of Zn+S and Zn+Se powders for various periods. The intensity of the long-lived positron lifetime component is shown to increase with grinding time until an abrupt decrease takes place at a specific grinding time, indicating the onset of the effective chemical reaction. The suitability of positron annihilation for investigating mechanochemical reactions is clearly demonstrated.

57488 (INIS-mf—7059-Vol.2, pp vp) **Micellar effects on positronium lifetime in aqueous SDS solutions.** Vass, S.; Kajcsos, Zs.; Molnar, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:; Marczis, L. (Vasipari Kutato Intezet, Budapest (Hungary)); Stergiopoulos, C. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary). Kolloid Kemiai es Kolloidtechnologiai Tanszek). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Positron lifetime measurements have been performed in aqueous SDS (Sodium Dodecyl sulphate) Solutions. The lifetime distributions measured by fast-slow coincidence technique have been found to be influenced by surfactant concentration, which varied from $1.25x10^{-3}$ to $3.2x10^{-1}$ mol/dm^3. The lifetime of the long-lived component connected to positronium formation and decay increases with growing surfactant concentration. Lifetime data suggest that a direct positronium-micelle electron-exchange reaction leading to pick-off annihilation is contraindicated.

57489 (INIS-mf—7059-Vol.2, pp vp) **Short range order in the disordered states of selenium-tellurium mixtures.** Bellissent, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The local order of amorphous and liquid Sesub(1-x) Tesub(x) systems has been investigated by thermal neutron scattering in the concentration range up to x=0.4 for the amorphous alloy, and in the whole concentration range for the liquid state. A three-dimensional model of about 1000 atoms has been constructed using computer calculation in order to investigate the behaviour of the dihedral angle in the chains. Short range order of trivalent Te has been represented by a quasicrystalline model.

57490 (INIS-mf—7059-Vol.2, pp vp) **Direct evidence for intrinsically broken chalcogen chemical order in GeSesub(2x)Tesub(2-2x) alloy glasses.** Boolchand, P.; Bresser, W.J.; Suranyi, P. (Cincinnati Univ., OH (USA). Dept. of Physics); Neufville, J.P. de (Energy Conversion Devices, Inc., Troy, MI (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Melt-quenched GeSesub(2x)Tesub(2-2x) alloy glasses have been studied by ^{125}Te nuclear gamma resonance and differential scanning calorimetry. A large increase in the average quadrupole splitting that varies non-linear with x is observed. This is shown to provide evidence for at least two distinct chalcogen sites in these alloy glasses implying that the chemical order of the glass network is intrinsically broken.

57491 (INIS-mf—7059-Vol.2, pp vp) **Further localization studies of Co atoms diffused into silicon.** Dezsi, I.; Feher, S.; Forgacs, G.; Horvath, D.; Kotai, E.; Manuaba, A.; Mezey, G.; Molnar, B.; Nagy, D.L.; Zsoldos, E. (Koezponti Fizikai Kutato Intezet, Budapest (Hungary)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

^{57}Co atoms diffused at 1270 K for 1 hour into single crystals of Si have a single Moessbauer line at -0.059+-0.001 mm/s. Channelling studies show 77 per cent of the Co atoms to occupy substitutional sites. It is found that Co forms epitaxial $CoSi_2$ clusters in the Si lattice.

57492 (INIS-mf—7059-Vol.2, pp vp) **Amorphization of tellurium by ion implantation.** Langouche, G.; Dezsi, I.; van Rossum, M.; de Potter, M.; de Bruyn, J.; Schroyen, D.; Coussement, R. (Leuven Univ. (Belgium). Inst. voor Kernen Stralingsfysika). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

A Moessbauer study was performed on ^{125}Te after implantation into Te single crystals, held at different temperatures. It is shown that during implantation at liquid nitrogen temperature amorphization of the target occurs. The role of the target temperature in the Naguib and Kelly criterion for amorphization is discussed.

57493 (INIS-mf—7059-Vol.2, pp vp) **Investigation of ion-bombarded silicon by ellipsometry and channeling effect.** Lohner, T.; Mezey, G.; Kotai, E.; Manuaba, A.; Paszti, F.; Devenyi, A.; Gyulai, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:. 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Both ellipsometry and channeling measurements were applied to investigate how the surface layer of single crystal silicon becomes amorphous when subjected to implantation at different doses. The characteristic behaviour of ellipsometric parameters is reported in correlation with the increasing amount of buried disorder. The transition between partially disordered and fully amorphous phase is a breaking point on the PSI-Δ plot. The ellipsometric parameters of the highest dose implants follow the theoretical dependence.

57494 (INIS-mf—7059-Vol.2, pp vp) **TDPAC-study of amorphous NiP alloy produced by ion implantation.** Thome, L.; Bernas, H. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Heubes, P.; Deicher, M.; Recknagel, E. (Konstanz Univ. (Germany, F.R.). Fachbereich Physik). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The perturbed γ-γ angular correlation technique is applied to P-ion-implanted $Ni_{82}P_{18}$ (2.2×10^{17} P/cm^2). The disorder created by P-implantation is microscopically probed by the hyperfine interaction of radioactive ^{111}Cd nuclei which strongly suggests a homogeneous amorphous layer ranging from the surface to the P-implantation depth R(p)sub+ΔRsub(p) approximately 800 A. The structural phase transitions induced by annealing up to 1000 K and the subsequent crystalline phases are discussed together with recent results on electrodeposited alloys.

57495 (INIS-mf—7059-Vol.2, pp vp) **Resistivity and channeling studies of ion-implanted NiP and CoP systems.** Thome, L.; Mendoza-Zelis, L.; Brossard, L.; Krolas, K.; Chaumont, J.; Bernas, H. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Cohen, C. (Paris-7 Univ., 75 (France)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

In situ electrical resistivity and channeling experiments were performed on room-temperature implanted NiP and CoP alloys in order to study the evolution with implanted dose (up to 2×10^{17} P/cm^2) of the disorder created by P-implantation. For low P doses, the disorder is mostly present at the surface due to radiation-induced P diffusion from the implanted zone. As the dose increases, the disordered layer grows inward from there to form a homogeneous amorphous layer up to a depth Rsub(p)+ΔRsub(p).

57496 (INIS-mf—7059-Vol.2, pp vp) **Comparison of impurity defect structures formed by ion implantations in amorphous and crystalline silicon.** Weyer, G. (Aarhus Univ. (Denmark). Inst. of Physics); Damgaard, S.; Petersen, J.W.; Heinemeier, J. (The ISOLDE Collaboration, CERN, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Impurity defect structures in amorphous and crystalline silicon have been created by ion implantation of radioactive ^{119}In at room temperature. The defects have been studied by Moessbauer spectroscopy on the 24 keV gamma radiation of the daughter ^{119}Sn. Structurally similar complex defects are formed in both phases of the silicon host. The fraction of complex defects in crystalline silicon increases with increasing implanted dose in the dose range of 10^{11}-10^{15} atoms/cm^2. No pronounced discontinuity is observed for the critical dose (> approximately 10^{13} atoms/cm^2) where the implanted host volume is amorphised.

57497 (INIS-mf—7059-Vol.2, pp vp) **Investigation of ion-bombarded and annealed Si by UPS and RBS methods.** Petoe, G.; Lohner, T.; Gyulai, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics:; Kanski, J. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Fysik). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Si "111", and Si "100" were damaged by bombardments of Ar^+ and implantation of $^{31}P^+$ and of $^{28}Si^+$ ions. The structural disorder and electronic structure were measured in disordered and crystalline states. The ion-implanted (amorphous) surfaces had very different electronic structure in comparison with the crystalline state, but they are nearly equal to each other when the surfaces were argon ion-bombarded, while these surfaces were heavily damaged by RBS data. The amorphous-crystalline transition process detected by UPS and by RBS was different for Si "111" and Si "100", as well.

57498 (LBL—12849-Rev.) **Pre-eutectic densification in MgF_2-CaF_2.** Hu, S.C.; De Jonghe, L.C. (Lawrence Berkeley Lab., CA (USA)). Apr 1982. Contract W-7405-ENG-48. 10p. (CONF-820638—2-Rev.). NTIS, PC A02/MF A01. Order Number DE82015750.

From 5. international meeting of modern ceramics technologies; Lignano-Sabbiadoro, Italy (14 Jun 1982).

Increased densification rates were found as much as 200°C below the eutectic temperature (980°C) for MgF_2 containing small amounts of CaF_2. Constant heating rate and constant temperature sintering data, as well as microstructural developments indicated that solid state grain-boundary transport rates had been enhanced by the eutectic forming additive. The effect saturated at about 1 wt % CaF_2. The results suggest that densification of ceramic powders could be favorably affected without a substantial increase in the grain growth rate, by the addition of small amounts of eutectic forming additives, and sintering below the eutectic temperature. 6 figures.

57499 **(PNL-SA—10004) Radiation effects in curium-doped $Gd_2Ti_2O_7$ and $CaZrTi_2O_7$.** Wald, J.W. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1981. Contract AC06-76RL01830. 12p. (CONF-820547—11). NTIS, PC A02/MF A01. Order Number DE82014858.

From 84. annual meeting of the American Ceramic Society; Cincinnati, OH, USA (2 May 1982).

If the waste stream consists of commercial nuclear fuel waste, data suggest a potential exists for significant radiation induced changes in time periods less than a thousand years. The two crystal systems studied here illustrate the magnitudes and rates at which damage ingrowth might be expected in the most severe case. This work also illustrates that marked anisotropic expansion can occur in non-cubic structures as a function of accumulated radiation dose. Although it was not observed macroscopically in the present case, this nonuniform swelling might result in microcracking of the waste form host with a potential for increase in leach rates due to increased surface area.

57500 **(UCID—19229) Preliminary report on radiation-induced thermoluminescence in Climax Stock quartz monzonite.** Carlson, R.; Page, L.; Koons, L.; Sundbeck, C. (Lawrence Livermore National Lab., CA (USA)). Nov 1981. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01. Order Number DE82006921.

An examination has been made of the feasibility of using thermoluminescence (TL) for the self-dosimetry of the rock surrounding a canister of nuclear waste. The rock investigated was quartz monzonite from the Climax Stock, a granite intrusive at the Nevada Test Site. Samples of the rock were irradiated by ^{60}Co to doses of 10^3 to 10^9 rads, then ground to a fine powder and read for TL response at a heating rate of 1°C per second. Effects of total dose, thermal history after irradiation, grinding to a powder after irradiation, mineral composition, and powder grain size were investigated. All were found to be important, but with care, the use of TL in this manner appears promising.

57501 **(UM-P—81/64) Rhombohedral crystal structure of Na-A zeolite; a powder neutron diffraction study.** Cheetham, A.K.; Lodge, E.A.; Thomas, J.M.; Bursill, L.A. (Melbourne Univ., Parkville (Australia). School of Physics). 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701971.

A powder neutron diffraction structure analysis of a dehydrated Na-A zeolite with Si/Al ratio of unity confirmed that the space group is R3 and verified the Si:Al ordering scheme proposed by Bursill, Lodge, Thomas and Cheetham (J. Phys. Chem., (1981)). Each cuboctahedral cage of the aluminosilicate framework contains one 3-fold axis and each Si(Al) is connected via oxygen bridges to 3Al (Si) and one other Si(Al). Total profile analysis by the Rietveld method gave cell parameters $a = 17.392$ A, $\alpha = 59.62$ deg. and final profile reliability index as 9.78%.

57502 **Percolation-type behavior in black chrome selective solar films.** Zajac, G.; Ignatiev, A. (Department of Physics, University of Houston, Houston, Texas 77004). *Applied Physics Letters;* **41**: No. 5, 435-437(1 Sep 1982). Contract W-31-109-ENG-38.

The optical constants (n and k) and dc resistivity have been measured for black chrome particulate solar absorbing coatings for the purpose of defining the applicability of various inhomogeneous medium theories in the description of the black chrome optical response. It has been shown that percolation-type behavior does exist in the films and hence of the various theories, only those exhibiting percolation at the 0.3 packing fraction value determined for the black chrome films are applicable. The two valid approaches are an effective medium theory first proposed by Bruggeman and a modified Maxwell Garnett theory which includes a particle shape distribution.

57503 **Neutron diffraction study of light and heavy water mixtures at 25 °C.** Thiessen, W.E.; Narten, A.H. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Chemical Physics;* **77**: No. 5, 2656-2662(1 Sep 1982).

Neutron diffraction data of very high statistical accuracy for four mixtures of light and heavy water containing 0.01%, 35.79%, 67.89%, and 99.75% deuterium are presented. The dynamic corrections described in a preceding article yielded a self-consistent static coherent structure function for heavy water. For the other mixtures an empirical correction method was used. The four total structure functions were analyzed to yield the three partial structure functions a/sub OO/(k), a/sub OH/(k), and a/sub HH/(k). The function a/sub OO/(k) is not significantly different from previously obtained x-ray diffraction results. The partial structure functions for hydrogen interactions will provide a sensitive test for proposed models of liquid water.

57504 **Resistance probe for energetic particle dosimetry with applications for plasma edge studies.** Wampler, W.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **41**: No. 4, 335-337(15 Aug 1982). Contract AC04-76DP00789.

Changes in the electrical resistance of thin carbon films caused by implantation with hydrogen, deuterium, and carbon ions were measured for various incident energies and for particle fluences in the range from 10^{12} to 10^{17} at./cm^2. At low fluences the resistivity change is found to be proportional to the displacement damage caused by the incident particles. A model is presented which can be used to calculate the resistance change which is in good agreement with the measurements. It is proposed that by measuring the resistance change for carbon films exposed to the edge of magnetically confined plasmas the energy and the flux of incident ions and neutral atoms may be determined.

57505 **Low-dislocation-density GaAs epilayers grown on Ge-coated Si substrates by means of lateral epitaxial overgrowth.** Tsaur, B.; McClelland, R.W.; Fan, J.C.C.; Gale, R.P.; Salerno, J.P.; Vojak, B.A.; Bozler, C.O. (Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts 02173). *Applied Physics Letters;* **41**: No. 4, 347-349(15 Aug 1982).

Single-crystal GaAs layers have been obtained by means of lateral epitaxial overgrowth seeded within stripe openings in a SiO_2 mask over GaAs layers grown on Ge-coated Si substrates. Transmission electron microscope and scanning cathodoluminescence studies indicate that the laterally overgrown GaAs layers have a dislocation density of less than 10^4 cm^{-2}, compared to 10^7—10^8 cm^{-2} for the GaAs layers grown directly on the Ge/Si substrates. Initial experiments indicate that the electrical properties of the laterally overgrown layers are comparable to those of conventional GaAs epilayers grown on single-crystal GaAs substrates.

57506 **X-ray diffraction study and models of liquid ethane at 105 and 181 K.** Sandler, S.I.; Lombardo, M.G.; Wong, D.S.; Habenschuss, A.; Narten, A.H. (Department of Chemical Engineering, University of Delaware, Newark, Delaware 19711). *Journal of Chemical Physics;* **77**: No. 4, 2144-2152(15 Aug 1982).

The structure functions for liquid ethane at (1) $T = 105$ K and a molecular density rho = 0.012 70 A^{-3}, and (2) $T = 181$ K and rho = 0.011 10 A^{-3} have been derived from new x-ray diffraction data. Treating the —CH_3 group as a single scattering site, carbon—carbon (methyl—methyl) intermolecular pair distribution functions have been obtained from the structure function data by Fourier inversion. Using Monte Carlo simulation, no two-site exponential-6 interaction model, with sites at the observed C—C bond length, could be found which reproduce the carbon—carbon distribution function. By considering a different class of interactions models, a model was found which reproduced the distribution function derived from experiment and accurately predicts the second virial coefficient of ethane.

57507 Effect of heavy metallic ions on fatty acid monolayers at the air—water interface. Miyano, K.; Abraham, B.M.; Xu, S.Q.; Ketterson, J.B. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **77**: No. 4, 2190-2192(15 Aug 1982). Contract W-31-109-ENG-38.

We have studied the effect of Ba^{2+} and Pb^{2+} ions on the pressure-area behavior of fatty acid (C/sub n/-1H/sub 2n/-1COOH) monolayers at the air—water interface for n = 15—21.

57508 Study of cathode edge emission. Zhao, Y. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Journal of Applied Physics;* **53**: No. 8, 5447-5452(Aug 1982). Contract AC03-76SF00515.

A great deal of experimental evidence shows that the perveance of high-power klystrons is much higher than normal at low voltage. Thus the three-halves power law is violated in that range. It is hypothesized that this is caused by edge emission. A detailed analysis is given. The calculated magnitude is reasonably coincident with experimental results. The analysis is also valid for other thermionic tubes.

57509 Material state of ion-implanted Cr in GaAs. Pronko, P.P.; Rai, A.K.; Holland, O.W.; Appleton, B.R.; Narayan, J. (Universal Energy Systems, Incorporated, 3195 Plainfield Road, Dayton, Ohio 45432). *Journal of Applied Physics;* **53**: No. 8, 5621-5629(Aug 1982). Contract W-7405-ENG-26.

Chromium-implanted GaAs has been studied using 120 keV implants to fluence levels from 1 x 10^{14} to 5 x 10^{16} cm^{-2}. The postannealed materials state has been examined using Rutherford backscattering spectrometry, proton-induced x-ray excitation, channeling, and transmission electron microscopy. Annealing was performed in flowing H_2 at 900 C for 15 min under 85-nm thick Si_3N_4 dielectric caps. Various stages of precipitation were observed having structure and composition that depended on total implanted fluence. For the highest fluence, coarse nonuniform second-phase precipitates were present with dimensions on the order of 50 to 100 nm. At lower fluences small defect cluster precipitates, with average diameters of 6 nm, were identified through black-white contrast analysis. The relative fraction of precipitated Cr was 40% at 1 x 10^{15} cm^{-2} and decreased to 9% at 5 x 10^{14} cm^{-2}. The volume concentration of implanted Cr that is retained in solid solution after annealing is estimated at 2 x 10^{18} cm^{-3}. Channeling analysis suggests that these atoms are retained in nonunique interstitial or other nonsubstitutional positions.

57510 Dislocation-free zone model of fracture comparison with experiments. Ohr, S.M.; Chang, S. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Applied Physics;* **53**: No. 8, 5645-5651(Aug 1982). Contract W-7405-ENG-26.

The dislocation-free zone (DFZ) model of fracture has been extended to study the relationship between the stress intensity factor, extent of plastic deformation, and crack tip geometry of an elastic-plastic crack as a function of applied stress. The results show that the stress intensity factor K decreases from the elastic value at first slowly, then goes rapidly to zero as the number of dislocations in the plastic zone increases. The crack with a zero stress intensity factor has its crack tip stress field completely relaxed by plastic deformation and hence is called a plastic crack. Between the elastic and plastic cracks, a wide range of elastic-plastic cracks having both a stress singularity and a plastic zone are possible. These elastic-plastic cracks with a DFZ are predicted if there is a critical stress intensity factor K/sub g/ required for the generation of dislocations at the crack tip. The expression for K/sub g/ is obtained from the crack tip dislocation nucleation model of Rice and Thomson. In most metals, the magnitude of K/sub g/ is less than the critical stress intensity factor for brittle fracture K/sub c/. The values of K are determined from electron microscope fracture experiments for various metals and they are found to be in good agreement with the K/sub g/ predicted from the model. It is concluded that for most ductile and semibrittle metals, the mechanism of dislocation generation is more important than the fracture surface energy in determining the stress intensity factor at the crack tip.

57511 Transient capacitance studies of an electron trap at E/sub c/-E/sub T/ = 0.105 eV in phosphorus-doped silicon. Jellison, G.E. Jr. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Applied Physics;* **53**: No. 8, 5715-5719(Aug 1982). Contract W-7405-ENG-26.

A new electron trap has been observed in electron-irradiated n-type silicon at E/sub c/-E/sub T/ = 0.105 eV using transient capacitance techniques. It is shown that this trap is related to another trap at E/sub c/-E/sub T/ = 0.172 eV and that one trap can be converted to the other by altering the voltage pulsing scheme across the p-n junction. In particular, the maximum transient capacitance response from the trap at E/sub c/-E/sub T/ = 0.105 eV occurs when the majority carrier pulse width (t/sub w/) is smaller than some time constant (tau/sub w/) and when the time-between-pulses (t/sub p/) is larger than another time constant (tau/sub p/). Emission time and capture cross-section measurements indicate that the trap at E/sub c/-E/sub T/ = 0.172 eV is closely related to the oxygen-vacancy defect (A center). It is believed that both these traps are different configurations of the same defect, the defect possibly being an impurity atom trapped by an A center.

57512 Determination of grain-boundary recombination rates by scanned spot excitation methods. Seager, C.H. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **53**: No. 8, 5968-5971(Aug 1982). Contract AC04-76DP00789.

Laser- and electron-beam induced-current techniques have been used to determine minority carrier diffusion lengths and grain-boundary recombination velocities in polycrystalline silicon. Data obtained on a variety of grain boundaries appear to be in good agreement with the recent calculations by Zook.

57513 Addendum: New model of electron free path in multiple layers for Monte Carlo simulation. Hawryluk, R.J.; Hawryluk, A.M.; Smith, H.I. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Journal of Applied Physics;* **53**: No. 8, 5985(Aug 1982).

In this note, it is shown that the previous Monte Carlo simulations of energy dissipation in polymer films by electron beam scattering [R. J. Hawryluk, A. M. Hawryluk, and H. I. Smith, J. Appl. Phys. 45, 2551 (1974)] are consistent with the recent calculation of S. Horiguchi et al. [Appl. Phys. Lett. 15, 512 (1981)]. Such Monte Carlo simulations have been widely used in electron beam lithography.

57514 Phonon imaging of highly dislocated LiF. Northrop, G.A.; Cotts, E.J.; Anderson, A.C.; Wolfe, J.P. (Physics Department and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review Letters;* **49**: No. 1, 54-57(5 Jul 1982). Contract AC02-76ER01198.

It has been found that high-frequency acoustic phonons with certain polarizations can propagate ballistically through a highly deformed LiF crystal. With use of the method of phonon imaging, a large anisotropy has been observed in the phonon-dislocation interaction: the crystal acts as a phonon polarizer. The data are consistent with the fluttering dislocation-model. Phonon focusing and anisotropic-scattering processes profoundly affect the transport of heat through a dislocated crystal.

57515 Ion—surface interactions during vapor phase crystal growth by sputtering, MBE, and plasma-enhanced CVD: Applications to semiconductors. Greene, J.E.; Barnett, S.A. (Departments of Metallurgy, The Coordinated Science Laboratory, and the Materials Research Laboratory University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Journal of Vacuum Science and Technology;* **21**: No. 2, 285-302(Jul 1982). Contract AC02-76ER01198.

The effects of low-energy particle bombardment of growing films during vapor phase epitaxy are considered in some detail. Ion bombardment plays an important and sometimes dominant role in controlling the growth kinetics and physical properties of films deposited by glow discharge and ion beam sputter deposition, molecular beam epitaxy using accelerated dopants, and plasma- assisted chemical vapor deposition. Ion—surface interaction effects, including trapping, sputtering, preferential sputtering, and collisional mixing, are used to interpret and model experimental results concerning the effects of low-energy particle bombardment on nucleation, film growth, enhanced diffusion at interfaces, and elemental incorporation probabilities. Finally, recent results on the growth of unique single-crystal metastable semiconducting alloys are discussed.

57516 **Electronic structure of the π-bonded chain model and the nonbuckled antiferromagnetic insulator model for the Si(111) surface.** Northrup, J.E.; Cohen, M.L. (Department of Physics, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California, 94720). *Journal of Vacuum Science and Technology;* **21**: No. 2, 333-336(Jul 1982). Contract W-7405-ENG-48.

The electronic structure of the Si(111) surface is investigated with the pseudopotential method and the local density functional formalism. The π-bonded chain model proposed by Pandey is found to be more stable than the nonbuckled antiferromagnetic insulating surface by 0.15 eV/ (surface atom).

57517 **Giant replicate cell approach to the electronic structure calculation of graded interface regions.** Ching, W.Y. (Department of Physics, University of Missouri—Kansas City, Kansas City, Missouri 64110). *Journal of Vacuum Science and Technology;* **21**: No. 2, 398-401(Jul 1982). Contract AC02-79ER10462.

The usual approach to the theory of interfacial electron states is to assume that the interfaces join abruptly. A multilayer slab geometry is then elected for the calculation of electronic states using methods of varying degree of sophistication. In many cases, the interfaces between semiconductors or dielectric insulators may involve a transition region of several atomic layers. The electron states at one side of the transition region may be quite different from those of the other side. The artificial abrupt connection of the two faces in this case will result in a great strain of bonds at the interface and could lead to the identification of unrealistic interfacial states. An alternate approach to this problem is proposed. We construct a series of giant periodic cells with atomic coordination commensurate with the bonding configurations of the interfacial region. A microscopic first-principles electronic structure calculation is then applied to each giant cell which replicates the bulk interfacial region. Information such as density of states, partial density of states, gap states, and electron localization can be obtained and correlated to the atomic structures. Results for density of states are presented for SiO/sub x/ with $x = 1.5$, 1.0, and 0.5 as would be appropriate for the Si—SiO_2 interfacial region. States at the upper region of the valence band are found to consist of mainly Si orbitals and their degree of localization is proportional to x. Application of this method to other compound semiconductor interfaces is also discussed.

57518 **Electronic structure of GaAs/sub x/P/sub 1-x// GaP strained-layer superlattices with $x<0.5$.** Osbourn, G.C. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology;* **21**: No. 2, 469-472(Jul 1982). Contract AC04-76DP00789.

The electronic properties of GaAs/sub x/P/sub 1-x// GaP(100) strained-layer superlattices with $x<0.5$ are studied using both a tight-binding model and an effective-mass model. By varying the alloy compositions and thicknesses of the layers, it is possible to independently vary the band gap and lattice constant of these structures. For the structures in which the bulk [100] minima are mapped into the strained-layer superlattice Γ point, a direct band gap occurs in the superlattice even though the bulk materials have indirect gaps. The results illustrate that strained-layer superlattices in general form a broad new class of semiconductor materials with tailorable electronic properties.

57519 **Growth and photoluminescence characterization of a GaAs/sub x/P/sub 1-x//GaP strained-layer superlattice.** Gourley, P.L.; Biefeld, R.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology;* **21**: No. 2, 473-475(Jul 1982). Contract AC04-76DP00789.

We have succeeded in growing a GaAs/sub x/P/sub 1-x// GaP strained-layer superlattice (SLS). The structure was grown by alternate metal—organic chemical vapor deposition of thin (60 A) layers (20 each) of GaAs/sub 0.4/P/sub 0.6/ and GaP. These layers were deposited onto a GaAs/sub x/P/sub 1-x/ layer which was graded in composition from $x = 0$ (composition of underlying GaP substrate) to $x = 0.2$ (average composition of SLS). Photoluminescence studies of the SLS were carried out to determine the optical band gap. At $T = 78$ K, the emission from the SLS exhibits a dominant peak at 2.03 eV, as well as weaker peaks at higher energies. We attribute these peaks to direct transitions between SLS conduction and valence band states. The measured energies for the fundamental gap and higher energy transitions are in good agreement with recent theoretical results.

57520 **Band structure of impurity-sheet-doped superlattice alloys.** Hjalmarson, H.P. (Division 5151, Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology;* **21**: No. 2, 524-527(Jul 1982). Contract AC04-76DP00789.

The band structure and density of states for large superlattices of (100) Ga-site Ge and As-site N impurity sheets in GaAs have been calculated by a semiempirical tight-binding technique. Both of these two-dimensional conduction-band derived bands with a J-point indirect minimum which is deep in energy (~0.5 eV) relative to the bulk conduction band edge. The calculation, which was performed on a single impurity sheet, demonstrates that, in general, a planar defect localizes or binds one or more states. It is suggested that the large binding energies of these sheets will confine electric-field-accelerated carriers and thus such superlattices will be highly conductive parallel to the impurity sheets.

57521 **Bound and resonant surface states at the (110) surfaces of AlSb, AlAs, and AlP.** Beres, R.P.; Allen, R.E.; Buisson, J.P.; Bowen, M.A.; Blackwell, G.F.; Hjalmarson, H.P.; Dow, J.D. (Department of Physics, Texas A&M University, College Station, Texas 77843). *Journal of Vacuum Science and Technology;* **21**: No. 2, 548-550(Jul 1982). Contract AC02-76ER01198.

The dispersion curves E(k-bar) have been calculated for bound and resonant (110) surface states of AlSb, AlAs, and AlP. AlSb is predicted to have no surface states within the bulk fundamental band gap, but AlAs and AlP are predicted to have surface state band minima which are very near the conduction band edge, and could lie either within the gap or immediately above the edge.

57522 **High Schottky barriers on and thermally induced processes at the Au— GaAs(110) interface.** Petro, W.G.; Babalola, I.A.; Skeath, P.; Su, C.Y.; Hino, I.; Lindau, I.; Spicer, W.E. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305). *Journal of Vacuum Science and Technology;* **21**: No. 2, 585-589(Jul 1982). Contract AC02-77CH00178.

New photoemission measurements show higher Schottky barrier heights (>1.3 eV) on atomically clean GaAs(110) surfaces at a Au coverage of about 25 monolayers. It is suggested that this effect is due to the movement of Au into the semiconductor; at room temperature it creates acceptor states near the valence band maximum (VBM) that cause the Fermi level at the surface (E/sub f/s) to move close to the VBM. We found that heating of the GaAs(110) surface (above 100 °C) covered with a small amount of Au (0.2 monolayer) causes E/sub f/s to move back to its original position (on the clean surface before Au deposition). The heating process is found to greatly inhibit the formation of large barrier heights due to the removal of defect states from the surface region.

57523 **Crystallographic relationships and interfacial properties of Ag on GaAs(100) surfaces.** Ludeke, R.; Chiang, T.; Eastman, D.E. (I.B.M. Thomas J. Watson Research Center, Yorktown Heights, New York 10598). *Journal of Vacuum Science and Technology;* **21**: No. 2, 599-606(Jul 1982). Contract AC02-76ER01198.

The crystallographic relationships, growth morphology, chemical activity, and electronic properties of Ag deposited at room temperature on GaAs(100) c(2 x 8) and (4 x 6) surfaces were investigated. Ag(110) growth was observed independent of growth rates. The growth is three- dimensional (nucleated) and the interfaces are abrupt. Stabilization of the Fermi level occurs beyond Ag coverages of 10 A, is uncorrelated with the appearance of the metallic Ag phase at ~0.5 A and appears to be dependent on the formation of atomiclike interfacial states near the bottom of the bandgap. Schottky barrier heights of 0.83 and 0.97 eV were determined for Ag on the c(2 x 8) and (4 x 6) surfaces, respectively. The results are at variance with current Schottky barrier models.

57524 **Hydrogen-induced disruption of oxygen-doped platinum coatings on glass microspheres.** Ping, W.L.; Meyer, S.F. (Lawrence Livermore National Laboratory, Box 808, Livermore, California 94550). *Journal of Vacuum Science and Technology;* **21**: No. 2, 689-694(Jul 1982). Contract W-7405-ENG-48.

Sputter-deposited platinum coatings on glass microspheres were severely disrupted after a deuterium—tritium (DT) mix was permeated into the hollow spheres under elevated temperature and pressure conditions. Optical, scanning electron microscope, and x-ray diffraction techniques were used to study the disrupted structure. This characterization, combined with results of separate sputtering experiments and literature information, suggested that hydrogen gas was occluded in the platinum rift structure during the high-pressure fill process. Subsequent release of the hydrogen pressure resulted in an expansion of the occluded gas; because diffusion rates were too low to relieve the stress concentrations thereby produced, the platinum coating delaminated along weakly bound interfaces. Neither oxygen present within the platinum structure nor water (as a Pt-catalyzed H_2+O_2 reaction product) appeared to contribute significantly to this disruption.

57525 **Application of PAS for the investigation of overtones and combination in the near IR.** Natale, M.; Lewis, L.N. (Monsanto Research Corporation, Mound, Miamisburg, Ohio 45342). *Applied Spectroscopy;* **36**: No. 4, 410-413(Jul 1982). Contract AC04-76DP00053.

The photoacoustic spectrometer (PAS) used in the near IR region is shown to be useful for observing the combinations and overtones of strong IR fundamentals. Overtones and combinations of the carbonyls in $Mo(CO)_6$, $Ir_4(CO)_{12}$, and $[RhCl(CO)_2]_2$ are observed. Carbonyl and ring (C—H, C—C) fundamental overtones and combinations from $(C_6H_6)Cr(CO_3$ are observed in the near IR. The near IR PAS is shown to be useful for analyzing surface constituents on silicon. An overtone and combination due to bound H_2O is identified on silicon by comparison to the near IR PAS spectrum of H_2O and D_2O. The C—N overtone band due to ferro- and ferricyanide is observed in the near IR by PAS. The spectrum of ferricyanide deposited on silicon is used to identify the surface changes that occur on a silicon photoelectrochemical cell coated with ferricyanide.

57526 **Very low-temperature search for superconductivity in semiconducting $KTaO_3$.** Thompson, J.R.; Boatner, L.A.; Thomson, J.O. (Department of Physics, The University of Tennessee, Knoxville, Tennessee, and Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Journal of Low Temperature Physics;* **47**: No. 5, 467-489(1 Jun 1982). Contract W-7405-ENG-26.

A series of attempts have been made to detect the presence of superconductivity in semiconducting potassium tantalate ($KTaO_3$) single crystals. Semiconducting potassium tantalate has a number of properties in common with semiconducting $SrTiO_3$, which is superconducting below ~0.3 K, with a critical temperature T/sub c/ that varies as a function of the carrier concentration. Both $KTaO_3$ and $SrTiO_3$ are perovskite-structure oxides and both materials are so-called incipient ferroelectrics that are characterized by high dielectric constants at low temperature. These common properties suggest that superconductivity might also be observed in semiconducting potassium tantalate. In the temperature range from 0.01 to 4.0 K, however, no evidence was found for superconductivity in $KTaO_3$ in the presence of magnetic fields of 10^{-5}—10^{-4} T(i.e., 0.1—1 Oe). Below 1.5 K, the search for superconductivity in $KTaO_3$ was carried out using a ^3He—^4He dilution refrigerator equipped with a SQUID magnetometer and an ac magnetometer. The system response was verified by measuring the paramagnetic susceptibility of DY_2O_3-doped $KTaO_3$. The failure to observe superconductivity in $KTaO_3$, while $SrTiO_3$ is an established superconducting material, may be related to the fact that the latter substance assumes a tetragonal symmetry phase at 105 K, while $KTaO_3$ remains cubic to low temperatures.

57527 **Neutron and Raman scattering at structural phase transitions.** Satija, S.; Cowley, R.A. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **25**: No. 11, 6765-6770(1 Jun 1982).

Neutron scattering measurements have been made of the soft mode in the uniaxial ferroelectric lead germanate for which the transition temperature is 450 K. The results are consistent with the simple soft-mode picture of the soft mode. A comparison with the results of Raman scattering measurements suggests that the latter measurements do not provide information about the one-phonon spectral function for temperatures greater than (T/sub c/-10) K.

57528 **Neutron scattering studies of spin waves in one-dimensional Heisenberg ferromagnet $CuCL_2$xDMSO (dimethyl sulfoxide).** Satija, S.K.; Axe, J.D.; Gaura, R.; Willett, R.; Landee, C.P. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **25**: No. 11, 6855-6859(1 Jun 1982).

We report the first results of a neutron scattering investigation of spin waves in a one-dimensional Heisenberg ferromagnet $CuCl_2$xDMSO (dimethyl sulfoxide). Experimentally obtained spin-wave linewidths near the zone boundary do not agree well with theories for classical 1 D Heisenberg ferromagnets, which suggests the presence of significant quantum corrections to the linewidths.

57529 **Successive structural phase transitions in Na/sub x/WO_3.** Sato, M.; Grier, B.H.; Shirane, G.; Akahane, T. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **25**: No. 11, 6876-6885(1 Jun 1982).

Three successive phase transitions, cubic I to tetragonal I to tetragonal II to cubic II, in the perovskite Na/sub x/WO_3 have been studied by neutron scattering. The softening of the M_3 phonon modes which correspond to a rotation of the WO_6 octahedra is observed in the cubic I phase, and the tetragonal I phase is confirmed to be a state resulting from a single M_3-mode condensation. Powder diffraction studies have shown that the other two low-temperature phases also result from M_3-mode condensations, confirming the structural model proposed by Clarke. Although at the second and the third transitions the axes of the resultant rotations change abruptly, the measured order parameter, which is proportional to the absolute rotation angle, does not have any appreciable discontinuity. This fact and the three successive M_3-mode condensations are unique compared with other successive phase transitions in insulating perovskite materials.

57530 **Spin correlations in nearly ferromagnetic Eu/sub x/Sr/sub 1-x/S.** Maletta, H.; Aeppli, G.; Shapiro, S.M. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **48**: No. 21, 1490-1493(24 May 1982). Contract AC02-76CH00016.

High-resolution neutron-diffraction measurements have been performed on a single crystal of Eu/sub x/Sr/sub 1-x/S for x = 0.52, an insulating spin system with competing exchange interactions. No detectable long-range magnetic order is observed at any temperature. However, intense magnetic diffuse scattering, well described by a Lorentzian, is present. As the temperature is reduced from 6 to 0.4 K, the magnetic correlation length ξ increases to a resolution-limited maximum (>400 A) at 2.5 K, and subsequently decreases.

57531 **Pair tunneling in $ErRh_4$ films.** Umbach, C.P.; Goldman, A.M. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review Letters;* **48**: No. 20, 1433-1436(17 May 1982).

Pair tunneling measurements have been carried out on $ErRh_4B_4$-Lu/sub x/O/sub y/-In thin film junctions. The Fraunhofer-like pattern of the magnetic-field dependence of the dc Josephson current has been found to split at a temperature just above the reentrant transition of $ErRh_4B_4$. This suggests the onset of a magnetic structure of semimacroscopic scale which does not break up the superconductivity of the $ErRh_4B_4$ electrode into disconnected domains, at least within the surface region probed (~150 A).

57532 Neutron scattering study of the lattice dynamics of Cr_3Si. Jorgensen, J.; Axe, J.D.; Corliss, L.M.; Hastings, J.M. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **25**: No. 9, 5856-5862(1 May 1982).

Phonons with wave vectors along [100], [110], and [111] directions and energies $<$ or $\approx$36 meV were measured in a large (1.2 cm^3) single crystal using triple-axis spectroscopy. Scattering intensities were used to make symmetry assignments for the $q = 0$ modes. A total of 15 of the expected 24 $q = 0$ modes are identified and show much accidental near-degeneracy. The Γ/sup prime/$_{25}$ mode frequency is in agreement with Raman results. A short-ranged central-force Born—von Karman model is constructed and used to discuss the results.

57533 Evidence for pressure-induced electronic changes in V_3Si. Lim, K.C.; Thompson, J.D. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **25**: No. 9, 6053-6056(1 May 1982).

We report for the first time direct evidence for pressure-induced electronic changes in transforming and nontransforming V_3Si. These observations may be understood qualitatively in terms of interband charge-transfer effects.

57534 Synthesis and characterization of a new surface derivatizing reagent to promote the adhesion of polypyrrole films to n-type silicon photoanodes: N-(3-(trimethoxysilyl)propyl) pyrrole. Simon, R.A.; Ricco, A.J.; Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge). *Journal of the American Chemical Society;* **104**: No. 7, 2031-2034(7 Apr 1982).

The synthesis, characterization, and application of N-(3-(trimethoxysilyl-propyl)pyrrole (I) as a photoanode derivatizing reagent that can be covalently anchored to the electrode via reaction of surface OH groups are described. The pendant group of I can then be used as the initiation site for polymerization of polypyrrole. The treatment of both Pt and n-type Si electrodes with I and films of polypyrrole to protect the semiconductor from photoanodic decomposition is described. Improved durability noted for the treated n-type Si electrodes is attributed to less H_2O/electrolyte undermining of the polymer when it is covalently anchored to the surface. (BLM)

57535 Superconducting V_3Si produced by pulsed laser annealing. Stritzker, B.; Appleton, B.R.; White, C.W. (Oak Ridge National Lab., TN (USA)); Lau, S.S. (California Inst. of Tech., Pasadena (USA)). *Solid State Communications;* **41**: No. 4, 321-324(Jan 1982).

Pulsed laser annealing has been utilized to fabricate superconducting V_3Si from multilayer V-Si thin film samples. It is demonstrated that a single laser pulse can induce mixing to form V_3Si in the A15 phase. The effects of multiple laser pulses and post thermal annealing on the superconducting transition temperature and width are presented, and a model is proposed to explain the effects of rapid heating and cooling on the V_3Si structure.

57536 Hydrogen and chlorine detection at the SiO_2/Si interface. Tsong, I.S.T.; Monkowski, M.D.; Monkowski, J.R. (Pennsylvania State Univ., University Park (USA)); Wintenberg, A.L.; Miller, P.D.; Moak, C.D. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **191**: No. 1-3, 91-95(31 Dec 1981).

From 5. international conference on ion beam analysis; Sydney, Australia (16 - 20 Feb 1981).

Hydrogen and chlorine depth profiles were obtained on a series of silicon oxides thermally grown in HCl/O_2 and Cl_2/O_2 ambients at 1100°C for 15 min using the ^{19}F nuclear reaction and SIMS techniques. The data shows close correlation between the H and Cl profiles in both the HCl/O_2 and Cl_2/O_2 oxides. While the H and Cl appear to be enriched at the SiO_2/Si interface of the HCl/O_2 oxides, they are higher in concentration and more evenly distributed in the oxide bulk of the Cl_2/O_2 oxides.

57537 Charge trapping and release in electron and gamma irradiated lead silicate glasses. Hong, C.M.; Day, D.E. (Missouri Univ., Rolla (USA). Dept. of Ceramic Engineering; Missouri Univ., Rolla (USA). Graduate Center for Materials Research); Weeks, R.A. (Oak Ridge National Lab., TN (USA)); Kinser, D.L. (Vanderbilt Univ., Nashville, TN (USA). Materials Science and Metallurgical Engineering). *Journal of Non-Crystalline Solids;* **46**: No. 3, 389-404(Dec 1981).

The thermally stimulated release of charge in electrically polarized and electron and gamma irradiated glasses containing 30 to 50 mol% PbO was investigated between 290 and 450 K. The release of trapped charge in irradiated glasses produced a thermally stimulated current peak which had the same activation energy as the depolarization current peak in electrically polarized specimens. The irradiation induced dielectric breakdown of these glasses was correlated with the quantity of trapped charge and the relaxation time for charge release determined from the thermally stimulated depolarization current.

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57538 (INIS-SU—111) Summaries of reports, presented by foreign scientists. Volume 7. (AN SSSR, Moscow). 1981. 126p. (In Russian and English). (CONF-8109168—Vol.7-Summ.). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780731.

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

Individual reports are indexed separately.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 55998, 56202, 56251, 56302, 56308, 56308, 56389, 56393, 56394, 56395, 56396, 56398, 56399, 56400, 56400, 56401, 56402, 56403, 56404, 56405, 56406, 56406, 56407, 56422, 56429, 56676, 57385, 57677, 57680, 57688, 57689, 57691, 57692, 57696, 57723, 58074, 58084, 58089, 58275, 58391

57539 (AD-A—110822/4) Laser desorption mass spectrometry. II. Applications to structural analysis. Technical report. Hercules, D.M.; Day, R.J.; Balasanmugam, K.; Dang, T.A.; Li, C.P. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). 2 Feb 1982. 39p. (TR—1). NTIS, PC A03/MF A01.

Laser desorption mass spectrometry (LDMS) is reviewed with focus on application to structural analysis of nonvolatile organic compounds. Models for the ionization-volatilization step are discussed with reference to solid-state vs. 'gas-phase' reactions. General characteristics of LDMS of organic compounds are discussed; for example, classes of compounds that generate M+ ions or (M+H)+ ions. Cationization reactions are considered; organic salts are discussed. Particular emphasis is placed on LDMS of high molecular weight compounds such as polysaccharides, polymers and vitamin B12 and its relatives. Problems of ion-molecule reactions complicating spectra are considered, particularly for transition metal coordination compounds. Other topics considered include quantitative analysis, microprobe applications and sample handling.

57540 (AD-A—111141/8) Investigation of laser induced fluorescence for concentration measurements of diatomic sulfur. Master's thesis. Robbins, T.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1981. 73p. (AFIT/GEP/PH—81D-8). NTIS, PC A04/MF A01.

This thesis investigated the feasibility of using laser induced fluorescence to measure S_2 number densities in a laboratory environment. The research was prompted by the growing interest in S_2, especially its potential as a tunable, high-power laser medium. In concept, laser induced fluorescence proved to be a feasible means of measuring S2 concentrations in a laboratory environment. Differences between the known and calculated number densities are attributed to the complexity of S2, quenching and radiation trapping, difficulties in measuring the effective lifetime, and inadequacies in the rate equation model.

57541 (AECL—7162) **Separation of sulphur-35 and phosphorus-32 from urine and their subsequent estimation.** Kramer, G.H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1981. 21p. (CONF-8010232—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702458.

From 26. annual bioassay, analytical and environmental chemistry conference; Ottawa, Ontario, Canada (14 Oct 1980).

A method has been developed that will specifically separate sulphur-35 and phosphorus-32 from urine. Interfering cations are removed by cation exchange and differential precipitation is used to remove the unwanted anion(s). The anion of interest is estimated by liquid scintillation counting and recoveries are 95% for sulphur-35 and 70% for phosphorus-32. The detection limits for sulphur-35 and phosphorus-32 are estimated to be 1.5 pCi and 1.3 pCi, respectively (1 pCi = 37 mBq).

57542 (CEA-CONF—6069) **Uranium content determination of ores in a truck.** Dumesnil, Patrice; Greco, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1981. 24p. (In French). (CONF-8110184—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702335.

From 7. European meeting on diagraphy; Paris, France (21 Oct 1981).

The description is given of an apparatus for determining the uranium level in an ore irrespective of knowing its radioactive balance. Its principle is as follows: the absorption cross-section of the gamma radiation by photoelectric effect is proportional to the 4.5 power of the atomic number Z of the absorbing element. The cross-section of photon scattering by Compton effect is a linear function of the rock density. The presence of a heavy element in the ore, even in a small quantity, will modify the gamma radiation spectrum in the low energy area whereas no significant modification will occur in the high energy range. The uranium will contribute significantly in deforming the spectrum of the radiation scattered by the environment. In order to use the method in a practical manner, two energy windows must be cut in the spectrum of the gamma radiation scattered: in the area of low energies to characterize the photoelectric effect and the range of high energies for the Compton effect. The tests performed have confirmed the validity of the selective natural gamma method.

57543 (DOE/ER/00854—38) **Fundamental studies of separation processes. Technical progress report, 15 August 1981-14 August 1982.** Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). 1982. Contract AS09-76ER00854. 12p. NTIS, PC A02/MF A01. Order Number DE82020009.

Three different types of studies are reported. First, vanadium-containing non-porphyrins from Venezuelan crude oil have been successfully fractionated using reverse phase liquid chromatography. In addition, using size-exclusion chromatography, compounds in later-eluding peaks have been shown to have much higher molecular weights than those eluting in earlier ones. A second study has involved preparations of commercially available polymers which were used in two different ways. In one, polystyrene, which consists of a series of oligomers, demonstrated the importance of the inter-relationship between pore size and specific surface area. Although narrow-pore silica packings may result in poor resolutions of higher molecular weight species due to steric exclusion, use of very wide-pore silica may also result in degraded separations due to an inadequate surface area on which adsorption can take place. In another study, the hydrodynamic radii of polyethyleneglycols were shown to change dramatically in the presence of certain salts. This confirms earlier evidence from mass spectrometry and from viscosity measurements. The final study reports the use of lightly coated 1 mm glass beads as a column packing for recycle gas chromatography. Partial separation of benzene from perdeuterobenzene has been obtained in relatively few cycles.

57544 (INFN/TC—80/15) **Multielemental analysis by proton nuclear activation in human serum.** Cantone, M.C.; Molho, N.; Pirola, L. (Milan Univ. (Italy). Ist. di Fisica; Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 25 Nov 1980. 10p. B, MF A01. Order Number DE82903238.

Portions of document are illegible.

An investigation of the quantitative content of several trace elements in human serum by proton nuclear activation (PNA) technique has been performed. The results concerning the quantitative determination of the concentrations of Sr, Cu, Fe, Zn and Se in serum are presented. Proton beams of 13.5 MeV and 23 MeV of the AVF cyclotron of the University of Milan have been used to induce respectively (p,n) and (p,2n) reactions on the nuclei of the elements under study. The quantitative determination has been obtained by the internal reference method and by comparison with a standard sample of serum doped with known quantities of the elements of interest. In order to compare the results obtained with different methodologies, measurements of PNA, atomic absorption and x-fluorescence have been performed on the same serum.

57545 (INIS-mf—7116, pp vp) **Fluorine in some Australian coals using the $^{19}F(p,\alpha\gamma)$ reaction.** Tiller, E. (Darling Downs Institute of Advanced Education, Toowoomba (Australia)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

57546 (INIS-SU—86, pp 268-269) **Macrocyclic extractants.** Zolotov, Yu.A.; Ionov, V.P.; Bodnya, V.A.; Larikova, G.A.; Vlasova, G.E.; Rybakova, E.V.; Niz'eva, N.V.; Bajramova, D. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57547 (INIS-SU—86, pp 287-288) **New class of sorbents for recovery of heavy metals in analysis of objects of non-ferrous metallurgy.** Malofeeva, G.I.; Petrukhin, O.M.; Shestakov, V.A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57548 (INIS-SU—86, pp 306) **Study of sorption of certain element trace amounts by manganese dioxide.** Plotnikov, V.I.; Shcherbov, D.P.; Likhanova, L.N. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57549 (INIS-SU—86, pp 321-322) **Ion-selective electrodes on the base of ionic associates of rare earth salicylates with rhodamine B.** Tselik, E.I.; Poluehktov, N.S. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57550 (INIS-SU—86, pp 327-328) **Synthesis and investigation of extraction properties of alkyl- and functionally-substituted macrocyclic ligands.** Shabanov, A.L.; Mamedova, Yu.G.; Elchiev, A.B.; Ehfendiev, A.G.; Babaev, G.A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57551 (INIS-SU—86, pp 405-406) **Crown-ethers as the class of stereospecific reagents for separation of elements like in properties.** Laskorin, V.N.; Yakshin, V.V.; Filippov, E.A.; Abashkin, V.M. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57552 (INIS-SU—111, pp 78-79) **Studies on the recovery of valuable associated minerals from tin ores.** Topfer, E.; Zonnchen, W. 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57553 (INIS-SU—111, pp 105) **Kinetics of solvent extraction of metal chelates.** Freiser, H. (Arizona Univ., Tucson (USA). Dept. of Chemistry). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57554 (K/TL/AT—147) **Determination of trace impurities in uranium hexafluoride using inductively coupled plasma-atomic emission spectroscopy.** Floyd, M.A.; Morrow, R.W.; Lazader, W.B.; Farrar, R.B.; Halouma, A.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jun 1982. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE82020072.

A procedure has been developed to determine 30 trace elements in high-purity uranium hexafluoride (UF_6) using inductively coupled plasma-atomic emission spectroscopy. The analytical method consists of a liquid-liquid extraction of the uranium from the trace impurities with a tri-(2-ethyl-hexyl)-phosphate (TEHP)-hexane mixture. A computer-controlled scanning monochromator system interfaced to an inductively coupled plasma (ICP) is then used to determine the levels of 30 trace elements present in the UF_6. A single sample dissolution procedure is used for all elements investigated. This preliminary report details experimental work done to date as part of a countinuing program to determine metallic impurities in uranium by ICP.

57555 (LA-UR—82-1929) **Synchronous detection of laser-induced fluorescence.** Quigley, G.P. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 17p. (CONF-820734—1). NTIS, PC A02/MF A01. Order Number DE82019571.

From Workshop on remote detection of hazardous materials; Gaithersburg, MD, USA (21 Jul 1982).

Many toxic or carcinogenic organic molecules have large absorption and fluorescence emission cross sections and can thus be detected by laser-induced fluorescence (LIF) in liquid samples at parts-per-billion levels or better. The technique of synchronous detection of laser-induced fluorescence (SDLIF) provides a way to distinguish between the fluorescence from a toxic molecule and the fluorescence from a background substance. This is done by synchronously scanning the laser excitation and fluorescence detection wavelengths at a fixed wavelength separation. What is measured in the overlap integral of the excitation and emission spectra that is considerably narrower than the entire fluorescence spectrum. The discussion of these techniques is centered on the point and remote detection of polynuclear aromatic hydrocarbons, aromatic amines, and organophosphates having applications in certain manufacturing processes as well as in coal liquefaction and gasification plants.

57556 (LBL—13867) **In-situ, real-time measurement of NO, NO_2, and SO_2 by tunable atomic line molecular spectroscopy (TALMS).** Hadeishi, T.; McLaughlin, R. (Lawrence Berkeley Lab., CA (USA)). Jan 1982. Contract AC03-76SF00098. 8p. (CONF-820612—9). NTIS, PC A02/MF A01. Order Number DE82020123.

From Symposium on instrumentation and control for fossil energy processes; Houston, TX, USA (7 Jun 1982).

Portions of document are illegible.

TALM spectroscopy consists of splitting a source atomic emission spectral line by means of a magnetic field (Zeeman effect) and making a differential absorption measurement between one Zeeman component that has been magnetically tuned to match an analytic absorption line and unmatched Zeeman reference component. The difference in polarization between Zeeman components permits the matching and non-matching wavelengths to be alternately selected and the differential absorption measured very rapidly with an electro-optical device called a current controlled retardation (CCR) plate. A block diagram of the TALMS instrumentation is given. (WHK)

57557 (NIM—2117) **Disc storage of the data obtained from photographic plates in spark-source mass spectrometry.** Pearton, D.; Heron, C. (National Inst. for Metallurgy, Randburg (South Africa). Analytical Chemistry Div.). 14 Jul 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82902825.

A description is given of the theory and mechanism of a computer program that stores, on floppy discs, data obtained from the photographic plates in spark-source mass spectrometry. This type of storage provides for the direct and rapid retrieval of information, and a permanent record of the data from the plates.

57558 (NIM—2132) **Assessment of pellicular anion-exchange resins for the determination of anions by ion chromatography.** Pohlandt, C. (National Inst. for Metallurgy, Randburg (South Africa). Analytical Chemistry Div.). 30 Oct 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82902826.

Because pellicular anion-exchange resins suitable for the determination, by ion chromatography, of anions with alkaline eluents were unavailable in South Africa at the inception of this work, an attempt was made to prepare such resins. In this study it is shown that the pellicular resins produced are more efficient than the surface-aminated resins used previously. The simultaneous separation and determination of five common anions is demonstrated. The method was applied to the analysis of uranium leach liquors, effluent samples, and a solid sample of ferric oxide (goethite).

57559 (PB—82-163882) **Nuclear data for the efficiency calibration of germanium spectrometer systems: measurements from the laboratories of the International Committee for Radionuclide Metrology alpha-, beta-, and gamma-ray spectrometry group. Final report.** Hoppes, D.D.; Schima, F.J. (National Bureau of Standards, Washington, DC (USA)). Jan 1982. 155p. (NBS-SP—626). NTIS, PC A08/MF A01.

Members of the Alpha-, Beta-, and Gamma-Ray Spectrometry Group of the International Committee for Radionuclide Metrology agreed in 1979 to collect the nuclear data from any measurements in their laboratories that were pertinent to the calibration of the efficiency of germanium spectrometer systems. This report is composed of the contributions from 14 laboratories, as listed in part II. If a self-contained contribution was received, it has been incorporated without editing. Less formal communications, or references to published articles, are discussed in short comments prepared by the compilers. Part IV is a compilation of a selected portion of the data, arranged by radionuclide.

57560 (ZfK—462) **Magnetic texture: atlas of magnetic sheet and fibre pole figures for neutron diffraction and Moessbauer effect.** Hennig, K.; Muecklich, A.; Wieser, E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Dec 1981. 14p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701972.

Magnetic pole figures can be obtained with the help of neutron diffraction and Moessbauer spectroscopy. At present their interpretation is based on model consideration. For this purpose an atlas of magnetic sheet and fibre pole figures suitable for neutron and Moessbauer data was set up for systematically chosen momentum distributions.

57561 **Angle resolved photoelectron spectroscopy of CS_2 and COS measured as a function of photon energy from 21 to 70 eV.** Carlson, T.A.; Krause, M.O.; Grimm, F.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Chemical Physics;* **77**: No. 4, 1701-1709(15 Aug 1982).

Data have been taken on both the partial cross sections and angular distribution parameters for the first five bands in CS_2 with a photon energy from 21 to 70 eV and for the first four bands of COS from 21 to 40 eV. The results are compared with calculations based on the multiple scattering method. In the case of photoionization of the 2π/sub g/ orbital of CS_2 and the 3π orbital of COS, the experimental results and calculations have been successfully explained in terms of the Cooper minimum. The behavior of the fifth band of CS_2 is accounted for by assigning it to a satellite peak arising from photoionization of the 2π/sub u/ orbital by way of configuration interaction. Comparison between the experimental results and calculations showed some problem areas, particularly with regard to the prediction of shape resonances, and suggestions are made for future improvement of the calculations.

57562 **Experimental evidence for the competition between resonantly enhanced multiphoton ionization and third-harmonic generation in xenon.** Glownia, J.H.; Sander, R.K. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **49**: No. 1, 21-24(5 Jul 1982).

Competition between third-harmonic generation and multiphoton ionization in xenon is confirmed in a direct experiment using counterpropagating circularly polarized laser beams to suppress third-harmonic emission. Three-photon resonantly enhanced multiphoton ionization through the 6s and 6s′ levels in xenon, previously reported to disappear at pressures above a few Torr, gives rise to sharp intense ionization signals under these conditions.

57563 **Observation of Rydberg(C^2Pi)-valence(B^2Pi) interactions in NO by multiphoton photoelectron spectroscopy.** White, M.G.; Seaver, M.; Chupka, W.A.; Colson, S.D. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **49**: No. 1, 28-31(5 Jul 1982). Contract AC02-76CH00016.

Photoelectron spectra for the three--photon resonant, five-photon ionization of NO via the $v'' = 0$ level of the $C^2Pi(3p\pi)$ Rydberg state show that $NO^+(X^1\Sigma^+)$ is formed primarily in $v' = 0$ and $v' >$ or $=3$. The relative populations of the $v' = 0$ to $v' >$ or $=3$ levels are strongly dependent on the excited rotational level of the C state. These data are consistent with known perturbations between the nearly degenerate C^2Pi, $v'' = 0$ Rydberg and B^2Pi, $v = 7$ valence levels.

57564 **Photon correlation spectroscopy used as a particle size diagnostic flames.** King, G.B.; Sorenson, C.M.; Lester, T.W.; Merkin, J.F. (Kansas State University, Manhattan, Kansas 66506). *Applied Optics;* **21**: No. 6, 976-977(15 Mar 1982). Contract AC02-80ER10677.

The feasibility of using photon correlation spectroscopy for the determination of particulate size in flames is demonstrated. The advantages of PCS include negligible perturbation of the system, real time analysis, and in situ measurements of particle sizes. (AIP)

57565 **Chromatographic studies of vanadium compounds from Boscan crude oil.** Spencer, W.A.; Galobardes, J.F.; Curtis, M.A.; Rogers, L.B. (Univ. of Georgia, Athens). *Separation Science and Technology;* **17**: No. 6, 797-819(1982). Contract AS09-76ER00854.

For the first time, vanadium nonporphyrins have been fractionated. Using graphite furnace atomic absorption, the signal for vanadium was found to follow the uv absorption of the chromatogram. In addition, a simpler, faster procedure has been devised to isolate a vanadium porphyrin fraction that was more nearly free from both vanadium nonporphyrins and nickel porphyrins. Pyrolysis/gas chromatography with both the flame photometric (sulfur) detector and the flame ionization detector gave evidence for a variety of sulfur species in both the porphyrin and nonporphyrin fractions.

57566 **Extraction of Am(III) and Eu(III) from aqueous ammonium thiocyanate by dihexyl-N,N-diethylcarbamolymethylphosphonate and related compounds.** Muscatello, A.C.; Horwitz, E.P.; Kalina, D.G.; Kaplan, L. (Argonne National Lab., IL). *Separation Science and Technology;* **17**: No. 6, 859-875(1982). Contract W-31-109-ENG-38.

The extraction behavior and separation factors of Am(III) and Eu(III) from low acid ammonium thiocyanate solutions were studied using dihexyl-N,N-diethylcarbamoylmethylphosphonate (DHDECMP) and related compounds. It was found that very dilute (<0.1 M) solutions of ammonium thiocyanate were sufficient to allow quantitative extraction of Am(III) with DHDECMP. Significant differences between DHDECMP and dibutylbutylphosphonate (DB[BP]) in the extraction of Am(III) and Eu(III) from thiocyanate were found and indicate chelation is occurring with DHDECMP, unlike the situation in the low acid lithium nitrate system. Infrared spectroscopy of the extracted complexes of La(III) and extraction studies with dihexyl-N,N-diethylcarbamoylethylphosphonate (DHDECEP), dihexyl-N,N-diisobutylcarbamoylmethylphosphonate (DHDIBCMP), and di-(2-ethylbutyl)-N,N-diethylcarbamoylmethylphosphonate (DEB-DECMP) confirm that chelation occurs with thiocyanate complexes of Am(III) and Eu(III). Separation factors, α, for Am(III) and Eu(III) were the lowest with DB[BP] ($\alpha = 5.84$) and the highest with DHDIBCMP ($\alpha = 10.8$).

57567 **Separation of zirconium and uranium.** Henry, H.G. (to Dept of the Interior). US Patent Application 266,225. 27 May 1981. 6p.

This invention relates to separation and recovery of zirconium from aqueous solutions containing zirconium and uranium. Separation of zirconium from uranium is, however, difficult since the uranium tends to accompany the zirconium in the solvent extraction and stripping steps. It is therefore desirable, and an object of the invention, to provide a simple and economical way of removing a major portion of the zirconium from the zirconium and uranium-containing strip solutions, with minimal removal of uranium. It has now been found, according to the present invention, that such a removal of zirconium may be accomplished by means of a process involving precipitation of zirconium from such zirconium and uranium-containing feed solutions by means of tartaric acid or a tartrate.

57568 **Method for the determination of ^{237}Np in low-level environmental samples.** Holm, E.; Nilsson, M. (Lund Univ. (Sweden). Radiofysiska Institutionen). pp 43-47 of Techniques for identifying transuranic speciation in aquatic environments. Proceedings of a technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges: techniques for identifying the speciation, jointly organized by the IAEA and the CEC and held in Ispra, Italy, 24-28 March 1980. Vienna, Austria; IAEA (1981).

From Technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges; Ispra, Italy (24 Mar 1980).

A method for the determination of ^{237}Np in environmental samples was developed. A radiochemical procedure based on isolation of neptunium from other interfering α-particle emitters by precipitations and ion exchange was employed. The radiochemical yield was determined by use of ^{239}Np and Ge(Li) spectrometry. ^{237}Np was counted with silicon surface barriers detectors. Biological samples up to 200g dry weight were processed with a minimal detectable activity of the order of 10fCi at 10^6s counting time.

57569 **Methods used at CNEN for the analysis of Pu and ^{241}Am in marine samples.** Delle Site, A.; Marchionni, V. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari). pp 49-54 of Techniques for identifying transuranic speciation in aquatic environments. Proceedings of a technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges: techniques for identifying the speciation, jointly organized by the IAEA and the CEC and held in Ispra, Italy, 24-28 March 1980. Vienna, Austria; IAEA (1981).

From Technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges; Ispra, Italy (24 Mar 1980).

Very low levels of plutonium (sup(239,240)Pu and ^{238}Pu) in marine samples (sea water, sediments, marine organisms) are determined by extraction chromatography with tri-n-octyl phosphine oxide (TOPO) supported on microporous polyethylene, electrodeposition and α-spectrometry. ^{236}Pu or ^{242}Pu is added as the yield detector and a high-resolution α-spectrometer is used for counting. The final recoveries are 62.6%+-9.7(sigma) for sea water, 45.4%+-9.6(sigma) for sediments and 81.7%+-4.5(sigma) for marine organisms. The method enables sup(239,240)Pu and ^{238}Pu to be detected at the femtocurie level. A method proposed for americium analysis in 50g sediments is also described. After leaching of the samples, uranium, plutonium and thorium are extracted with TOPO, leaving americium, curium, lanthanides and iron in the aqueous phase. The organic phase is processed for plutonium, while in the aqueous solution separation of transplutonium elements from iron is obtained by a double oxalate co-precipitation. The decontamination of americium from the other transuranics is improved by extraction chromatography with di-2-ethylhexyl phosphoric acid (HDEHP). The final separation from lanthanides is obtained by a double anion-exchange step in thiocyanate media. Americium is electroplated and counted by α-spectrometry. The recovery ranges between 25 and 35%.

57570 **Future developments in laser technology and their applications.** Boyer, K. (California, University, Los Alamos, NM). pp 500-504 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

One of the many areas in which lasers are beginning to play an important role is that of chemistry. One application of great significance is the use of low average power tunable lasers as an analytical tool to measure or study reaction kinetics and products. The other application of equal or greater importance is the use of high average power tunable lasers as a manipulative tool to control or drive chemical reactions in industrial processes. Here the cost of photons is the most important factor and a new device called the 'Free Electron Laser' is under development which promises to reduce the photon cost to less than one dollar per pound of material, thus including a wide range of industrial products.

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REFER ALSO TO CITATION(S) 56450, 57688, 57689, 57693, 57696, 57732, 58209, 58284, 58337

57571 **(AD-A—109368/1) Configurational effects in the adsorption of HD on ZnO. Technical report.** Griffin, G.L.; Yates, J.T. Jr. (National Bureau of Standards, Washington, DC (USA). Surface Science Div.). Dec 1981. 12p. (TR—24). NTIS, PC A02/MF A01.

Hydrogen deuterate, (HD), adsorption on ZnO surfaces has been studied by infrared spectroscopy as a function of ZnO temperature. It is shown that at 300K, the configuration Zn(H)-O(D) is preferred, as expected on thermodynamic grounds. As the temperature is lowered, the configuration Zn(D)-0(H) becomes preferred on kinetic grounds. We demonstrate that configuration reversal on heating must proceed via HD desorption and subsequent re-adsorption. This behavior is consistent with a model in which the transition state for HD adsorption is characterized by nearly complete dissociation of the H-D bond.

57572 **(AD-A—110138/5) Magnetic ordering in oxide solid solutions. Final scientific report 1 Sep 79-31 Aug 81.** Cheetham, A.K. (Oxford Univ. (UK). Chemical Crystallography Lab.). 6 Jan 1982. 9p. NTIS, PC A02/MF A01.

Powder neutron diffraction, magnetic susceptibility and Mossbauer spectroscopy have been used to investigate solid solutions based upon MnO, FeO, CoO and NiO, and we have completed measurements on NiO-CoO, MnO-CoO, NiO-MnO, FeO-MnO and FeO-CoO. In each system we have examined the changes of spin direction and crystal symmetry as a function of temperature and composition in the antiferromagnetic phases. The results show that the strength of the magnetic anisotropy associated with the metal ions falls in the sequence Co2+>Mn2+>> Fe2+-Ni2+-. This order is different from that found in mixed fluorides of the type K2MF4(Co2+>Fe2+>Ni2+), and we have considered, in some detail, the unexpected weakness shown by Fe2+ in our materials.

57573 **(AD-A—111175/6) Spectroscopic analysis of PbO chemiluminescence.** (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1981. 82p. (AFIT/GEP/PH—81D-9). NTIS, PC A05/MF A01.

A lead oxide (PbO) flame was generated in a flow tube reactor by reacting lead vapor generated in a furnace with the oxidizers O2 and N2O. The emissions from the chemiluminescent flames were analyzed by means of a Jarrell Ash 0.25 m spectrograph and photomultiplier operating in the region 2000-8000 A. Rovibronic bands assignable to the x-a, x-b, x-A, x-B electronic systems were observed. The assignments compare well with published work. Spectra obtained with the two different oxidizers were compared. Significant differences in spectral line intensities were recorded. The pressure dependence of the intensities was also measured. Again, significant differences were recorded when the two different oxidizers were used. In the Pb + O2 reaction a low pressure enhancement of various lines was observed. Significant differences between the chemistry of these low pressure reactions and the chemistry of similar reaction of high pressure were observed.

57574 **(AD-A—111282/0) Adsorption of H_2 isotopes on ZnO: coverage induced ir frequency shifts and adsorbate geometry. Technical report.** Griffin, G.L.; Yates, J.T. Jr. (National Bureau of Standards, Washington, DC (USA). Surface Science Div.). Feb 1982. 28p. NTIS, PC A03/MF A01.

The coverage dependence of the IR stretching frequencies for dissociative Type I adsorption of H2 and D2 on ZnO powders has been measured using transmission IR spectroscopy. By comparing the frequency shifts observed when the isotopic composition of the adsorbate is varied at constant total coverage with the shifts observed when the total coverage of either pure component is varied, we can separate the dynamic and static contributions to the coverage induced frequency shifts. The ZnH and ZnD shifts are due primarily to electrodynamic interactions. The observed shifts are in good agreement with the Hammaker model for dynamic dipole-dipole interactions, if adsorption is assumed to occur on (2 x 2) reconstructed ZnO (0001) surface planes. In contrast, the OH and OD shifts are due to electrostatic and inductive interactions. The electrostatic contribution can be estimated using a modification of Buckingham's treatment of local environment effects. A qualitative model, based on electron localization effects, is presented to explain the observed inductive contribution.

57575 **(AD-A—111394/3) Heat capacity of water at extremes of supercooling and superheating. Technical report.** Angell, C.A.; Sichina, W.J.; Oguni, M. (Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). Dec 1981. 25p. NTIS, PC A02/MF A01.

Low temperature heat capacities for water and deuterium oxide have been remeasured using different sample preparation and data analysis procedures from those used in the original studies of this anomalous region. Self-consistent results have been obtained with reproducibilities of 1%. Comparisons are made with the behavior in the superheated region at 1 atm pressure calculated from a refined equation of state by Haar et al. It appears that the kinetic metastability limit of the liquid (nucleation terminated) at both hot and cold extremes may be reached at the same value of the liquid heat capacity.

57576 (ATR—82-8424-1) **Chemical stability of barium calcium aluminate dispenser-cathode impregnants.** Lipeles, R.A.; Kan, H.K.A. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 1 Aug 1982. 38p. Aerospace Corporation, Laboratory Operations, El Segundo, CA 90245.

A thermodynamic model has been formulated to describe the effects of temperature and composition on the chemistry of barium and barium oxide (Ba/BaO) generation from dispenser cathode impregnants. Our approach is to make use of the $BaO\text{-}CaO\text{-}Al_2O_3$ phase diagram and BaO vapor pressures of impregnant phases to calculate the BaO vapor pressure of the impregnant. This BaO vapor pressure is used to calculate the Ba vapor pressure resulting from reactions between BaO vapor and the tungsten cathode. The Ba/BaO vapor pressures are used to calculate Ba/BaO generation and evaporation rates from a wide range of impregnant compositions. Ba/BaO evaporation rates from dispenser cathodes, reported in the literature over a range of Ba and calcium (Ca) concentrations, are consistent with the rates predicted from this study. Two trends are evident. First, increasing the Ba concentration in the impregnant generally forms high vapor pressure Ba-rich phases leading to high Ba/BaO evaporation rates. Second, increasing Ca concentration in the impregnant lowers in the Ba/BaO vapor pressures by forming more stable barium-calcium-aluminate solid solutions. Ca has little effect on Ba/BaO vapor pressure once its solubility limit is reached and a separate CaO phase is formed. This model illustrates the possibility of extending cathode life by selecting impregnants composed of fairly stable solid-solution phases for use in cathodes that must be operated at high temperature for high current density.

57577 (BNL—31632) **Laser studies of radiationless decay mechanisms in $Os^{2+}/^{3+}$ polypyridine complexes.** Netzel, T.L.; Bergkamp, M.A. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-8205114—1). NTIS, PC A02/MF A01. Order Number DE82019530.

From American Chemical Society symposium on inorganic chemistry; Bloomington, IN, USA (16 May 1982).

The lowest energy excited states in Os(II) polypyridine complexes are of a metal-to-ligand charge transfer (MLCT) type and live for 10 to 40 μs at 4.2°K. The long wavelength absorptions in the visible region of the spectrum in Os(III) polypyridine complexes arise from ligand-to-metal charge transfer (LMCT) transitions and do not produce detectable luminescence. This suggests that these LMCT states are very short lived. Results of picosecond absorption studies on the lifetimes the LMCT states in $OsL_3{}^{3+}$ complexes [L = 2,2′-bipyridine(bpy) or 1,10-phenanthroline(phen)] as functions of temperature and isotopic substitution are reported. The LMCT lifetimes at low temperature are contrasted with the low temperature lifetimes of the MLCT states of $OsL_3{}^{2+}$ complexes and both are examined from the perspective of a coarse-grained radiationless decay theory developed by Englman, R. and Jortner, J. (Molec. Phys. 1970, 18, 145). The agreement between experiment and theory suggests the following: (1) Englman and Jortner's theory of radiationless decay is useful for inorganic as well as organic systems; (2) mid-frequency (1300 to 1600 cm^{-1}) vibrations are the important energy accepting modes for radiationless decay of the charge transfer excited states of $OsL_3{}^{2+}/^{3+}$ complexes and; (3) the 10^5-10^6 difference in lifetimes between the MLCT states of $OsL_3{}^{2+}$ complexes and the LMCT states of $OsL_3{}^{3+}$ complexes is largely due to the difference in their energy gaps.

57578 (DOE/ER/05031—4) **Isotope effects in the solution of gases in liquids. Progress report, July 1, 1981-July 30, 1982.** Benson, B.B.; Krause, D. Jr. (Amherst Coll., MA (USA)). 30 Jul 1982. Contract AC02-78ER05031. 12p. (COO—5031-4). NTIS, PC A02/MF A01. Order Number DE82019919.

For pure aqueous solutions of simple gases, interpretation of our isotopic fractionation data in terms of an harmonic potential model has indicated a possible relationship between solute cavities in water and cages in Structure I clathrate hydrates. This suggested that experiments be carried out to see if isotopic fractionation of guest molecules occurs during the formation of clathrates. Preliminary work shows that for argon 36/40 enclathrated at 77°K a fractionation of 12.6 per mil occurs between the enclathrated gas and that in the vapor phase. Because the structure of clathrates is well known, isotopic measurements of this kind may be useful not only with respect to clathrates but also for a better understanding of liquid water. Manometric methods are being used for very accurate determinations of changes in the thermodynamic properties of gaseous solutions when deuterium is substituted for hydrogen in water. For example, at 5°C neon is 14.7% more soluble in D_2O than it is in H_2O. Work is continuing on the clathrates, on solubilities in D_2O, and on isotopic fractionation of gases dissolved in nonaqueous solutions.

57579 (DOE/ER/10984—6) **Separated isotopes: vital tools for science and medicine.** (National Research Council, Washington, DC (USA). Committee on Chemical Sciences). 1982. Contract FG01-81ER10984. 283p. NTIS, PC A13/MF A01. Order Number DE82018407.

This report summarizes the deliberations and conclusions of a Workshop on Stable Isotopes and Derived Radioisotopes organized by the Subcommittee on Nuclear and Radiochemistry of the National Research Council's Committee on Chemical Sciences at the request of the Department of Energy (DOE). The workshop was jointly supported by the National Institutes of Health and DOE's Office of Basic Energy Sciences. An Overview with three recommendations resulting from the Workshop, prepared by the Steering Committee, is followed by Chapters 1 to 4, reports of the following four Workshop panels: (1) panel on research applications in physics, chemistry and geoscience; (2) panel on commercial applications; (3) panel on biomedical research applications; (4) panel on clinical applications. Background papers were prepared by individuals on the Steering Committee and made available to all participants prior to the Workshop. They proved of great value and are reproduced as Appendixes 3 to 8. Short reports on alternate separation techniques were presented at the Workshop and are reproduced in Appendixes 9 to 11. Selected papers have been abstracted and indexed.

57580 (DOE/ER/10984—6, pp 3-14) **Research applications in physics, chemistry, and geoscience.** 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

Research applications of separated stable isotopes are presented in the field of nuclear physics and chemistry, solid state physics and chemistry, geoscience, fission and fusion reactor technology, and for analytical uses. The consumption of these isotopes in physics, chemistry and geoscience is presented in a table for the years 1979 to 1981. The 20 isotopes for which the largest expenditures were made are also listed in a table. Excluding the light isotopes ^6Li, ^7Li and ^{10}B, the annual rate of consumption from 1979 to 1981 was nine gram atoms per year. If non-destructive uses are included, the usage rate was about 160 gram atoms per year. At current prices, the consumption rate corresponds to an expenditure of roughly $500,000 per year. Scientific progress is now seriously hampered by the unavailability of 60 of the 240 isotopes normally for sale. It is vital that the sales inventory of stable isotopes be restored to an adequate level as soon as practicable. For certain use of enriched isotopes, such as in ion sources, where high enrichment is not always required, isotopes may become available through separation techniques at substantially less expense than electromagnetic separation.

57581 (DOE/ER/10984—6, pp 15-21) **Commercial applications.** 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

The objective of this paper is to assess the near term (one-to-five-year) needs of domestic and foreign commercial suppliers of radiochemicals and radiopharmaceuticals for electromagnetically separated stable isotopes. Only isotopes purchased to make products for sale and profit are considered in this assessment. Radiopharmaceuticals produced from enriched stable isotopes supplied by the Calutron facility at ORNL are used in about 600,000 medical procedures each year in the United States. A temporary or permanent disruption of the supply of stable isotopes to the domestic radiopharmaceutical industry could curtail, if not eliminate, the use of such diagnostic procedures as the thallium heart scan, the gallium cancer scan, the gallium abscess scan, and the low-radiation-dose thyroid scan. The word could in the preceding sentence is underlined because an alternative source of enriched stable isotopes does exist in the USSR. Alternative starting materials could, in theory, eventually be developed for both the thallium and gallium scans. The development of a new technology for these purposes, however, would take at least five years and would be expensive. Hence, any disruption of the supply of enriched isotopes from ORNL and the resulting unavailability of critical nuclear medicine procedures would have a dramatic negative effect on the level of health care in the United States.

57582 (DOE/ER/10984—6, pp 23-27) **Biomedical research applications.** 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

The biomedical research Panel believes that the Calutron facility at Oak Ridge is a national and international resource of immense scientific value and of fundamental importance to continued biomedical research. This resource is essential to the development of new isotope uses in biology and medicine. It should therefore be nurtured by adequate support and operated in a way that optimizes its services to the scientific and technological community. The Panel sees a continuing need for a reliable supply of a wide variety of enriched stable isotopes. The past and present utilization of stable isotopes in biomedical research is documented in Appendix 7. Future requirements for stable isotopes are impossible to document, however, because of the unpredictability of research itself. Nonetheless we expect the demand for isotopes to increase in parallel with the continuing expansion of biomedical research as a whole. There are a number of promising research projects at the present time, and these are expected to lead to an increase in production requirements. The Panel also believes that a high degree of priority should be given to replacing the supplies of the 65 isotopes (out of the 224 previously available enriched isotopes) no longer available from ORNL.

57583 (DOE/ER/10984—6, pp 29-32) **Clinical applications.** 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

The Oak Ridge Calutron facility has been a critical factor in the development and subsequent production of a majority of currently useful medical radionuclides. The role of stable isotopes in the development of radiopharmaceuticals is described. Some examples are: stable isotope molybdenum-98 for producing radiopharmaceuticals incorporating technetium-99m; thallium-203 precursor for thallium-201 which is used as tracers in the detection of coronary-heart disease; zinc-68 precursor of gallium-67 which is used in the diagnosis of tumors and infections. The continued availability of the isotopic materials necessary for optimal health care can only be achieved by taking the following actions: (1) stocks of all the stable isotopes from which products for research and patient care are derived must be expanded and maintained; (2) all facilities, including the calutrons, capable of furnishing products to meet these needs should be identified and described; federal support for the research and development of alternative separation methods should continue; (3) an advisory committee should be created to set realistic goals, to evaluate resources, and coordinate overall efforts.

57584 (DOE/ER/10984—6, pp 45-80) **Stable isotope enrichment program at Oak Ridge National Laboratory.** Newman, E. (Oak Ridge National Lab., TN). 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

By means of the isotope separation program at Oak Ridge National Laboratory (ORNL), electromagnetically enriched stable isotopes are made available to the worldwide scientific community. Among the topics discussed in this paper are the methods of enriching isotopes and the limitations that apply to the quantity and final assay of the separation products. A brief description of each production step, from the selection and preparation of initial feedstock to the recovery and distribution of isotopically enriched material, is presented. The future of the facility, the continued supply of enriched isotopes, and the response of the program to new and changing requirements are emphasized.

57585 (DOE/ER/10984—6, pp 81-153) **National uses and needs for separated stable isotopes in physics, chemistry, and geoscience research.** Zisman, M.S. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

Present uses of separated stable isotopes in the fields of physics, chemistry, and the geosciences have been surveyed to identify current supply problems and to determine future needs. Demand for separated isotopes remains strong, with 220 different nuclides having been used in the past three years. The largest needs, in terms of both quantity and variety of isotopes, are found in nuclear physics research. Current problems include a lack of availability of many nuclides, unsatisfactory enrichment of rare species, and prohibitively high costs for certain important isotopes. It is expected that demands for separated isotopes will remain roughly at present levels, although there will be a shift toward more requests for highly enriched rare isotopes. Significantly greater use will be made of neutron-rich nuclides below $A=100$ for producing exotic ion beams at various accelerators. Use of transition metal nuclei for nuclear magnetic resonance spectroscopy will expand. In addition, calibration standards will be required for the newer techniques of radiological dating, such as the Sm/Nd and Lu/Hf methods, but in relatively small quantities. Most members of the research community would be willing to pay considerably more than they do now to maintain adequate supplies of stable isotopes.

57586 (DOE/ER/10984—6, pp 269-270) **Isotope separation by gaseous and liquid thermal diffusion and by chemical exchange.** Wilkes, W.R. 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

MRC-Mound Laboratory separates isotopes by gaseous thermal diffusion, liquid thermal diffusion, and by chemical exchange. Gaseous thermal diffusion is now used only to separate noble gas isotopes and deuterium. Liquid thermal diffusion is currently used in the separation of chlorine, bromine and sulfur isotopes. As for chemical exchange, preliminary work has been done on separating calcium and sulfur, and current investigation is on separating a number of metal isotopes. Capital costs are substantial but overall efficiency is high. Chemical exchange is best suited to separation of annual quantities of 100g or more.

57587 (DOE/ER/10984—6, pp 271-272) **Laser isotope separation: an alternative production method.** Janes, G.S. (Avco Everett Research Lab., Inc., Everett, MA). 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

At present, less than five elements account for 70 to 80% of the demand for stable isotopes. This unbalanced demand severely limits the availability of the Calutrons at Oak Ridge for the task to which they are best suited, namely, the production of a wide variety of isotopes for research purposes. The atomic vapor laser isotope separation (LIS) process is an ideal supplementary alternative, since it offers the potential for rapid low-cost production of significant greater quantities of the isotopes in primary demand, mostly metals with mass numbers above 100. Fortunately, much of the R and D work on a process for separating uranium is also applicable to the separation of the isotopes of such elements as thallium, cadmium, osmium, tellurium, indium, and lead. These elements have qualitative similarities that would allow the development of a cost-effective laser process that could be used to produce isotopes of a number of elements without major hardware changes. Recently, Avco Everett Research Company has directed its attention towards developing such a process for the separation of thallium. It may now be possible to supply a significant fraction of the current national need for thallium by undertaking a two to three year effort that would involve spending about $1 million for R and D and perhaps $2 million for construction of a pilot plant.

57588 (DOE/ER/10984—6, pp 273-279) **Vacuum arc centrifuge.** Krishnan, M.; Hirshfield, J.L. 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

The separation of elements and isotopes by means of rotating magnetized plasma columns has been under study for the past two years at Yale. The instrument used in these studies is a laser-triggered vacuum arc centrifuge. Unlike its partially ionized gaseous predecessors, this vacuum arc centrifuge is sustained by the erosion and ionization of the cathode material, thus producing relatively pure, highly ionized, rotating plasma columns of the cathode material. Any solid metal, or mixture of metals, can be converted into plasma, and the constituent isotopes partially separated in the centrifuge, by fabricating the arc cathode out of the desired metals. The device also offers the possibility of operation with non-conducting solid elements or compounds by imbedding the desired substance in a conducting matrix. A wide variety of metals and combinations of metals have been studied so far, ranging from C through Cu to Cd/Sn. Typical angular rotation frequencies ~ 10^5 rad/sec have been measured, with concomitant enrichments up to a factor of two for ^{65}Cu. The device in its present form is not a viable source of partially enriched stable isotopes at a competitive cost. Nevertheless, reasonable estimates of the future capability and cost of a larger version of the device can be made. It should be emphasized that a concerted research and development effort would be a necessary prerequisite to making the device a practical isotope separator.

57589 (INIS-mf—7057) **Proceedings of the 3rd conference on colloid chemistry.** Pinter, J.; Wolfram, E. (eds.). (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary). Kolloid Kemiai es Kolloidtechnologiai Tanszek). 1981. 372p. (In Hungarian). (CONF-8104161—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE82780653.

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57590 (INIS-mf—7185) **Chlorine isotope effects in ion exchange reactions with a strongly basic anion exchanger.** Hoffmann, R. (Regensburg Univ. (Germany, F.R.). Naturwissenschaftliche Fakultaet 4 - Chemie und Pharmazie). 1976. 173p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82780729.

Thesis.

As can be shown by the results of this study, the chemical preenrichment of the stable chlorine isotopes in inorganic ion-exchange equilibria is feasible in principle. This process should be performed in chromotographic separation columns at temperatures as low as possible. Because of the dependence of the isotopic effect on the elution medium concentration a very low concentration is desirable for the chemical enrichment process. Smaller elution concentrations however result in increasingly longer elution times.

57591 (INIS-SU—86, pp 101) **Preparation and properties of ternary rare earth chalcopnictides.** Rustamov, P.G.; Aliev, O.M.; Il'yasov, T.M.; Maksudova, T.F.; Gejdarova, Eh.A.; Sadygov, F.M. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

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57592 (INIS-SU—86, pp 102) **Character of the interaction in ternary systems Me-Ga(In)-X (where Me = Mn, Fe, Co, Ni; X = S, Se, Te).** Rustamov, P.G.; Babaeva, P.K.; Azhdarova, D.S.; Askerova, N.A.; Allazov, M.R. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57593 (INIS-SU—86, pp 106) **Crystallochemical and physical properties of mixed europium chalcogenides of the $EuLn_2X_4$ type (Ln=rare earths from La to Yb; X=Se, S, Te).** Sadovskaya, O.A.; Eliseev, A.A.; Ponomarev, V.F.; Ehllert, O.G.; Kalinnikov, V.T. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

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57594 (INIS-SU—86, pp 109) **Synthesis and investigation of rare earth halogenides in the state of higher valency.** Spitsyn, V.I.; Martynenko, L.I.; Kiselev, Yu.M.; Brandt, A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

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57596 (INIS-SU—86, pp 114) **Synthesis and nature of graphite compounds with inorganic fluorides.** Uminskij, A.A.; Ippolitov, E.G.; Opalovskij, A.A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

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57597 (INIS-SU—86, pp 115) **Physicochemical properties of metal complexes with derivatives of phosphorus dithioacids.** Usova, S.V.; Solozhenkin, P.M.; Rakitina, E.V.; Kakovskij, I.A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

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57655 (INIS-SU—99) **Theoretical fundamentals of chemical technology. Chemical problems in metallurgy. Chemistry and technology of silicates. Volume 3. Annotations of reports and communications.** (AN SSSR, Moscow). 1981. 185p. (In Russian). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82780646.

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57656 (INIS-SU—111, pp 12) **Chemisorption of chlorine on metal oxides.** Bayar, B.; Evdokimov, V.I. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57657 (INIS-SU—111, pp 13) **New trends in phosphate chemistry: phosphate-tellurates and phospho-chromates.** Durif, A.; Averbuch-Pouchot, M.T. (Centre National de la Recherche Scientifique, 38 - Grenoble (France)). 1981. Dep. NTIS (US Sales Only).

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57658 (INIS-SU—111, pp 16-17) **Complexes of adenosine-5'-monophosphate and cytidene-5'-monophosphate with transition metal ions.** Katsarov, N.; Grigoratou, A.; Kaloulis, P.; Sideris, E. (Democritos Nuclear Research Center, Athens (Greece)). 1981. Dep. NTIS (US Sales Only).

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57659 (INIS-SU—111, pp 18-19) **Comparative thermogravimetric study on the chlorination reactions of various metal oxides.** Bertoti, I.; Pap, I.S.; Toth, A.; Szekely, T. (Magyar Tudomanyos Akademia, Budapest). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57660 (INIS-SU—111, pp 19-21) **MS and IR studies on the chlorination reaction of various metal oxides.** Szekely, T.; Podor, B.; Bertoti, I.; Mink, G.; Zelei, B. (Magyar Tudomanyos Akademia, Budapest). 1981. Dep. NTIS (US Sales Only).

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57661 (INIS-SU—111, pp 21-22) **Syntheses and reactions of new 9-10 atom carbaboranes.** Stibr, B.; Base, K.; Janousek, Z.; Dolansky, J. (Ceskoslovenska Akademie Ved, Prague). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57662 (INIS-SU—111, pp 31) **New synthesis of boron hydrides.** Prochazka, V.; Zapletal, V.; Urbanova, M. (Ceskoslovenska Akademie Ved, Prague). 1981. Dep. NTIS (US Sales Only).

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57663 (INIS-SU—111, pp 40-41) **Some recent achievements in the knowledge of the electronic structure of coordination compounds from photoelectron spectroscopic techniques.** Furlani, C.; Mattogno, G.; Cauletti, C. (Rome Univ. (Italy). Ist. di Chimica Generale ed Inorganica). 1981. Dep. NTIS (US Sales Only).

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57664 (INIS-SU—111, pp 43-44) **Molybdenum-95 nuclear magnetic resonance properties of molybdenum-oxo, -sulfur and -selenium species.** Wedd, A.G. (La Trobe Univ., Bundoora (Australia)). 1981. Dep. NTIS (US Sales Only).

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57665 (INIS-SU—111, pp 46-47) **Studies on metal complex catalyzed decomposition of organic hydroperoxides by NMR method.** Trzeciak, A.M.; Ziolkowski, J.J. (Wroclaw Univ. (Poland) Inst. Chemii). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57666 (INIS-SU—111, pp 47-48) **Syntheses and reactions of new 9-10 vertex azaboranes.** Base, K. (Ceskoslovenska Akademie Ved, Prague). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57667 (INIS-SU—111, pp 48-50) **Some investigations of binary molten salt mixtures.** Emons, H.-H. (Bergakademie Freiberg (German Democratic Republic)). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57668 (INIS-SU—111, pp 79-81) **New heteropolytungstates with transition metals Ti(4) and Ni(2) as heteroatoms.** Marcu, Gh.; Rodica Vatulescu; Budiu, T. (Academia R.S.R., Cluj (Romania). Inst. de Chimie). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57669 (INIS-SU—111, pp 90-92) **Rare-earth borocarbides-preparation and physical properties.** Etourneau, J.; Tarascon, J.M.; Hagenmuller, P. (Centre National de la Recherche Scientifique, 38 - Grenoble (France); Bordeaux-1 Univ., 33 - Talence (France)). 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57670 (INIS-SU—111, pp 101-102) **Chemical transport reactions in systems containing several coexisting phases and phases with a homogeneity range: transport of the binary and ternary molybdenum sulfides MoS_2, Mo_2S_3 and $PbMo_6S_8$.** Krabbes, G.; Oppermann, H. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung:. 1981. Dep. NTIS (US Sales Only).

From 12. Mendeleev's conference on general and applied chemistry; Baku, USSR (21 Sep 1981).

57671 (LA-UR—82-2190) **Condensed-matter research at the Los Alamos pulsed neutron source (WNR).** Eckert, J. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 18p. (CONF-820935—1). NTIS, PC A02/MF A01. Order Number DE82019531.

From 6. Yamada conference on neutron scattering of condensed matter; Tokyo, Japan (1 Sep 1982).

The experimental program at the WNR in condensed matter research at present is aimed principally at utilizing the high epithermal neutron flux available at a spallation neutron source. Interesting new results have been obtained in several areas including hydrogen vibrations in metals, chemical vibrational spectroscopy and the structure of liquids. For example, extensive vibrational spectra were obtained of hydrogen in Nb which could be described in terms of a three-dimensional localized anharmonic oscillator, deuterium substitution methods were used to determine the variation with 0-0 distance of the hydrogen bending mode frequency in extremely short intramolecular hydrogen bonds, and model-independent partial structure factors were determined for liquid water.

57672 **Theoretical studies of the chemisorption of hydrogen on copper.** Madhavan, P.; Whitten, J.L. (Department of Chemistry, State University of New York at Stony Brook, Stony Brook, New York 11794). *Journal of Chemical Physics;* **77**: No. 5, 2673-2683(1 Sep 1982).

The chemisorption of H_2 on Cu(100) is treated using a many-electron embedding theory in which the copper lattice is modeled as a 38-atom cluster. Ab initio valence (4s) CI calculations carried out on a local electronic subspace permit an accurate description of bonding at the surface. Dissociated hydrogen is found to bind exotherimically to the (100) surface at several stable adsorption sites in fourfold, bridge, and atop atom H positions. Calculated H_2 binding energies are in the range 13—22 kcal/mol. However, high energy barriers to dissociation of 35—40 kcal/mol exist due to the repulsion of molecular H_2 by the surface and the difficulty of stretching H_2 significantly above the surface. A characteristic of stretched or dissociated H_2 is the occurrence of H levels well up into the Cu 4s band from 5.5 to 7.8 eV below E/sub F/.

57673 **Evidence for two different transition states in the reaction of $NO+O_3 \rightarrow NO_2+O_2$.** van der Ende, D.; Stolte, S.; Cross, J.B.; Kwei, G.H.; Valentini, J.J. (Fysisch Laboratorium, Katholieke Universiteit, Toernooiveld, 6525 ED Nijmegen, The Netherlands). *Journal of Chemical Physics;* **77**: No. 4, 2206-2208(15 Aug 1982).

Chemiluminescent cross sections have been obtianed for NO_2^*. (AIP)

57674 **Reaction rates of hydroxyl radical with nitric acid and with hydrogen peroxide.** Marinelli, W.J.; Johnston, H.S. (Department of Chemistry, University of California and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **77**: No. 3, 1225-1234(1 Aug 1982).

The rates of the reactions $HO+HNO_3 \rightarrow H_2O+NO_3$, (1), $HO+H_2O_2 \rightarrow H_2O+HOO$ (2) have been studied by laser flash photolysis of reactants and resonance fluorescence of hydroxyl radicals. The recently reported high rate constants at room temperature for both reactions and the negative activation energy for Reaction (1) at low temperature have been confirmed. Results obtained here are: $k_1 = 1.52 \times 10^{-14} \exp(644/T)$ cm^3 molecule^{-1} s^{-1} from 218—363 K and $k_2 = 1.81 \times 10^{-12}$ cm^3 molecule^{-1} s^{-1} at 298 K. These two reactions have been examined by transition-state theory; (1) is assigned a cyclic and (2) a chainlike transition state. Even with no potential energy barrier, the reaction coordinate of (1) involves a quantum-mechanical, temperature independent frequency; and with this model the low pre-exponential factor and negative activation energy of Reaction (1) can be explained.

57675 **Neutron vibrational spectroscopy of hydrogen and deuterium on Raney nickel.** Cavanagh, R.R.; Kelley, R.D.; Rush, J.J. (National Measurements Laboratory, National Bureau of Standards, Washington, D.C. 20234). *Journal of Chemical Physics;* **77**: No. 3, 1540-1547(1 Aug 1982).

Incoherent neutron inelastic scattering has been applied to the study of the chemisorption of hydrogen and deuterium on Raney nickel (a high surface area nickel powder). The binding sites have been identified by comparing the vibrational frequencies and intensities provided by the inelastic scattering with calculations for model structures of different geometries, force constants, and symmetries. We conclude that, on Raney nickel above 150 K, hydrogen chemisorbs predominantly in sites of threefold symmetry. The "best fit" corresponds to a Ni—H bond distance of 1.88 +- 0.03 A and a force constant of 0.58 +- 0.03 mdyn/A. In addition, we have observed lateral adsorbate interactions, deuterium isotope shifts, and temperature dependent binding sites.

57676 **Vibrational fine structure in the valence ionizations of transition-metal hexacarbonyls: new experimental indication of metal-to-carbonyl π bonding.** Hubbard, J.L.; Lichtenberger, D.L. (Univ. of Arizona, Tucson). *Journal of the American Chemical Society;* **104**: No. 8, 2132-2138(21 Apr 1982).

The first observations of metal-carbon vibrational structure in photoionization bands are reported. Attention is focused on the predominantly metal d ionizations of $M(CO)_6$ (M = Cr, Mo, and W), and the methods for obtaining high resolution and very high signal-to-noise He I ionization data are detailed. The ^2T/sub 2g/ ionization band of $Cr(CO)_6$ and the spin-orbit split $^2E''$ and $^2U'$ bands of $W(CO)_6$ show distinct vibrational progressions which correspond to the totally symmetric (a/sub 1g/) metal-carbon stretching mode in the positive ion states. The metal-carbon stretching frequencies are found to be significantly less in the positive ion states than in the ground states, indicating a reduction of metal-carbon bond order upon the loss of a t/sub 2g/ electron. Evaluation of the vibrational progressions shows that the metal-carbon bond length increases on the order of 0.10 A upon t/sub 2g/ ionization in the case of $W(CO)_6$ and about 0.14 A in the case of $Cr(CO)_6$. In addition, the beginning of a short progression in the a/sub 1g/ carbon-oxygen stretching mode is observed in the $Mo(CO)_6$ spectrum and is clearly seen in the $W(CO)_6$ spectrum. All of these observations show that removal of an electron from the predominantly metal t/sub 2g/ orbitals, which are strictly π symmetry with respect to the carbonyls, substantially weakens the metal-to-carbonyl bond. 9 figures, 2 tables.

57677 **Generation of titanocene and rhodocene cations in the gas phase by a novel metal-switching reaction.** Jacobson, D.B.; Byrd, G.D.; Freiser, B.S. (Purdue Univ., West Lafayette, IN). *Journal of the American Chemical Society;* **104**: No. 8, 2320-2321(21 Apr 1982). Contract AC02-80ER10689.

The generation of titanocene and rhodocene cations is reported in a metal-switching reaction between titanium and rhodium cations and two common metallocenes, ferrocene ($FeCp_2$) and bis(eta^5-cyclopentadienyl)nickel ($NiCp_2$). Charge exchange is the only major competing reaction observed. The experiments were performed on a prototype Nicolet FTMS-1000 spectrometer utilizing a 0.9-T magnetic field. The metal ions were formed by a Quanta Ray Nd:YAG laser that produced a 530-nm beam, which was focused onto a pure metal plate in the ICR(ion cyclotron resonance spectroscopy) cell. The metal ions were trapped in the presence of the sample gas for times ranging from 100 milliseconds to several s and products were detected mass spectrometrically. 2 figures.

57678 **Organolanthanide hydride chemistry. 1. Synthesis and x-ray crystallographic characterization of dimeric organolanthanide and organoyttrium hydride complexes.** Evans, W.J. (Univ. of Chicago, IL); Meadows, J.H.; Wayda, A.L.; Hunter, W.E.; Atwood, J.L. *Journal of the American Chemical Society;* **104**: No. 7, 2008-2014(7 Apr 1982).

Hydrogenolysis of $(C_5H_4R)_2Ln(t\text{-}C_4H_9)(OC_4H_8)$ (R = H, CH_3; Ln = Lu, Er, Y) in toluene at room temperature and atmospheric pressure forms the dimeric hydrides $[(C_5H_4R)_2Ln(OC_4H_8)(\mu\text{-}H)]_2$, which have been characterized by ir and ^1H and ^{13}C NMR spectroscopy, complexometric analysis, quantitative deuterolysis, and x-ray crystallography. The analogous deuterides were similarly prepared and characterized. $[(CH_3C_5H_4)_2Y(OC_4H_8)(\mu\text{-}H)]_2$ crystallizes from C_4H_8O/hexane in the monoclinic space group $P2_1/c$ with a = 8.731 (3) A, b = 19.772 (6) A, c = 9.054 (3) A, β = 98.71 (3)^0, and D/sub calcd/ = 1.38 g cm^{-3} for Z = 2 dimers. The complex has Y-H bond lengths of 2.17 and 2.19 A with a Y-H-Y angle of 114^0. The Y-0 and average Y-C(eta^5) distances are 2.460 (8) and 2.69 A, respectively.

57679 **Organolanthanide hydride chemistry. 2. Synthesis and x-ray crystallographic characterization of a trimetallic organolanthanide polyhydride complex.** Evans, W.J. (Univ. of Chicago, IL); Meadows, J.H.; Wayda, A.L.; Hunter, W.E.; Atwood, J.L. *Journal of the American Chemical Society;* **104**: No. 7, 2015-2017(7 Apr 1982).

A method is described for the preparation of trimetallic lanthanide polyhydrides via β-hydrogen elimination from the tert-butyllanthanide complexes in the presence of LiCl. The ir spectrum of the crystalline compound was recorded, and x-ray diffraction studies of the erbium compound identified it as $([(C_5H_5)_2E$ $rH]_3Cl)(Li(THF)_4]$. Some discussion of other aspects of the structure of the compounds is included. (BLM)

57680 Comparative studies of Mo-Mo and W-W quadruple bonds by SCF-Xα-SW calculations and photoelectron spectroscopy. Cotton, F.A. (Texas A & M Univ., College Station); Hubbard, J.L.; Lichtenberger, D.L.; Shim, I. *Journal of the American Chemical Society;* **104**: No. 3, 679-686(10 Feb 1982).

The homologous compounds $M_2Cl_4(PR_3)_4$, with M = Mo and W, have been used in a combined theoretical and experimental study to compare the electronic structures of quadruple bonds between molybdenum atoms and between tungsten atoms. The theoretical work was carried out by the SCF-Xα-SW method on the model systems with R = H, but using in all other respects the experimentally measured bond lengths and angles for the compounds with R = CH_3. Relativistic corrections were made for both the molybdenum and tungsten compounds, but were found to be significant only for the tungsten compound. The PMe_3 compounds were used for measurements, made with both He I and He II excitation, of the photoelectron spectra in the gas phase. For both compounds the highest filled orbital is the M-M δ-bonding orbital and the measured ionization energies are 6.44 and 5.81 eV for the Mo and W compounds, respectively. For both compounds the next observed ionizations, at 7.70 eV (Mo) and 7.05, 7.45 eV (W), can be assigned on experimental criteria to the M-M π-bonding orbitals. The spin-orbit splitting of the W-W π peak shows features attributable to mixing of σ, π, and δ components by the spin-orbit coupling operator. These peaks are followed by ionizations assignable to M-P bonding electrons at 8.41 eV (Mo) and 8.36 eV (W). The calculations predict this order correctly for the W compound but reverse the Mo-Mo π and Mo-P ionization energies. The W-W bonding appears to be weaker than the Mo-Mo bonding, and in general the results of this study are consistent with the greater reactivity (i.e., lower chemical stability) of the W-W quadruple bond as compared to the Mo-Mo quadruple bond. 15 figures, 5 tables.

57681 Heptamethylindenyl lanthanide(III) complexes of lanthanum, neodymium, and erbium. Tsutsui, M. (Texas A & M Univ., College Station); Chen, L.B.; Bergbreiter, D.E.; Miyamoto, T.K. *Journal of the American Chemical Society;* **104**: No. 3, 855-856(10 Feb 1982).

Both the steric bulk and the electronic character of this ligand resulting from the seven methyl groups favor the stabilization of the lanthanide-carbon bonds. Alkali metal salts of heptamethylindenide(Hmi) were used as precursors of the lanthanide complexes. Lanthanum, erbium or neodymium chlorides were added to a stoichiometric amount of potassium Hmi, allowing the mixture to stand at 25°C ca 2 days. The product was crystallized and purified by slowly evaporating the remaining THF solution. Solid impurities had already been removed by centrifugation. Complexes were all soluble in THF, benzene, cyclohexane, and unstable in carbon disulfide, alcohols, ketones, DMSO. Each complex was distinguished from the starting material by NMR, and was characterized by ir, uv and visible spectroscopy. 1 table.

57682 Preparation, structural characterization, and reactivity of $(PEt_3)_2(CO)Rh\text{-}Co(CO)_4$. A quantitative study of the reversible heterolytic cleavage of the polar Rh-Co bond. Roberts, D.A. (Pennsylvania State Univ., University Park); Mercer, W.C.; Zahurak, S.M.; Geoffroy, G.L.; DeBrosse, C.W.; Cass, M.E.; Pierpont, C.G. *Journal of the American Chemical Society;* **104**: No. 3, 910-913(10 Feb 1982).

The reversibility of the reaction has allowed a quantitative assessment of the kinetic lability of the cobalt-rhodium bond through detailed variable temperature NMR studies. $(PEt_3)_2(CO)Rh\text{-}Co(CO)_4$ was prepared by the dropwise addition of a THF solution of $K[Co(CO)_4]$ to a THF solution of $RhCl(CO)(PEt_3)_2$, under a nitrogen atmosphere. After stirring the mixture at 50°C for 24h, the THF was removed and the residue extracted with petroleum ether. Cooling the extract to -65°C produced a 77% yield of the complex. The solid state structure is illustrated; values for relative bond angles and bond lengths are given. Structural data indicate that the complex is coordinately unsaturated and is best formulated as possessing a polar-metal Rh(I) and Co(-I) center. The $[Co(CO)_4]^-$ group behaves as a pseudohalide, the Rh-Co interaction is relatively weak, easily displaced by acetonitrile and THF. The rate of metal bond cleavage is extremely fast. 2 figures.

57683 Temperature swing process for hydrogen isotope separation. Hill, F.B.; Wong, Y.W.; Chan, Y.N.I. (Brookhaven Natl Lab, Upton, NY, USA). *AIChE (American Institute of Chemical Engineers) Journal;* **28**: No. 1, 1-6(Jan 1982).

Experiments on the separation of hydrogen isotopes were conducted using vanadium hydride in a temperature swing process. Process behavior followed trends predicted by an equilibrium theory of process operation, but was modified by a kinetic isotope effect and by finite rates of hydrogen absorption and isotope exchange. 8 refs.

57684 Reactions of sulfur dioxide with excess ammonia. Meyer, B. (Univ. of Washington, Seattle); Mulliken, B.; Weeks, H. *Phosphorus and Sulfur and the Related Elements;* **8**: 281-290(1980).

The reaction of SO_2 with excess NH_3 was studied during warm-up of rare gas matrices and in sealed pressure tubes containing various isotropic species. In the matrix experiments six ir bands belonging to ammonium thionylimide, NH_4:NSO, were observed in the temperature range between 40°K and 90°K. Above 80°K the spectrum of ammonium sulfite, NH_4SO_3 prevails. In sealed tubes containing liquid NH_3 at room temperature-several stepwise reactions can be followed. They consist of ammonolysis of SO_2, followed by auto-redox disproportionation of S/sup IV/ into a range of oxidation states. Raman spectra show the presence of sulfate, dithionate, thiosulfate, and the polythionates. Isotope substitution indicates that NH_3 does not participate in redox reactions and acts merely as a nucleophilic catalyst. The composition of the samples changes over a period of at least 2 y. In some tubes with $NH_3:SO_2 < 7$ a spontaneous reaction occurs after 1 1/2 to 2 y, and the colorless or pale yellow solution turns a brilliant violet signalling the decomposition of thiosulfate and polythionate into elemental S which reacts with the liquid NH_3 yielding negatively charged polysulfide radical ions.

57685 (INIS-mf—7117, pp vp) **Electron structure and lifetime of unstable species of nuclear transformations in the solid.** Grimm, R.; Guetlich, P. (Mainz Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie und Analytische Chemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

Temperature dependent post effects of the K capture decay of ^{57}Co in the $[^{57}Co/m(phen)_3](ClO_4)_2$ x nH_2O systems were observed with the help of time-integral and time-differential Moessbauer emission spectroscopy (M = Co,Fe). It is known from the Moessbauer absorption experiments on the inactive analogous iron compounds that the electron ground state of iron in these compounds is the low spin state, i.e. the $^1A_1$ state in Osub(h) symmetry. Additional resonances arise in the emission spectra which can be assigned to the Fe(II) in the high spin state $^5(T_2)$ by their Moessbauer parameter. The intensity of these resonances increases at the expense of low-spin intensity at low temperatures. The nucleogenic iron in the high-spin state is interpreted as unstable state resulting from the post effects of the ^{57}Co nulcear decay. The intensity of these secondary products exhibit a drastic influence of the host lattice (MCo,Fe). The lifetimes of the unstable high-spin species in the compound $[^{57}Co/Co(phen)_3](ClO_4)_2$ are obtained from the time differential Moessbauer emission spectra; the former vary between 20 ns and 400 ns in the temperature region between 220 and 4.2 K.

57686 (INIS-mf—7117, pp vp) **First tests on recoil separation of alkali and alkaline earth elements with macrocyclic polyethers.** Lochner, R.; Starke, K.; Duschner, H. (Marburg Univ. (Germany, F.R.). Fachbereich Physikalische Chemie; Marburg Univ. (Germany, F.R.). Fachgebiet Kernchemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

The special cage structure of the crown ether is very suitable to prevent back-exchange of the recoil atom with the target compound in the Szilard-Chalmers process. The kinetic and thermodynamic stability of the macrocyclic complexes formed is necessary for this. Fast separations are required for effective enrichment. Suitable separation techniques were developed in first exchange tests with catcher methods and heterogeneous extraction. Enrichment factors up to 62 could be achieved following 14 MeV neutron irradiation of [Sr (222)] $(NO_3)_2$/cellulose [Sr-88(n,2n) Sr-87m]. Factors upto 132 were obtained with [Sr(2sub(B) 22sub(B))]$(Pic)_2$ with heterogeneous extraction. These tests clearly show that effective recoil separations are possible when further optimizing this class of compounds.

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REFER ALSO TO CITATION(S) 56445, 57539, 57577, 57628, 57639, 57648, 57676, 57677, 57679, 57680, 57681, 57682, 57699, 57709

57687 (BNL—31559) **Resonance-fluorescence kinetic study of oxygen atom + hydrocarbon reactions, V: $O(^3P)$ + Neopentane (415-922K).** Michael, J.V.; Keil, D.G.; Klemm, R.B. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 22p. (CONF-820801—12). NTIS, PC A02/MF A01. Order Number DE82019526.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

Absolute values of the rate constants for the reaction of $O(^3P)$ with neo-C_5H_{12} were determined directly with the use of the complementary techniques: flash photolysis (FP) and discharge flow (DF). The O-atoms were monitored via resonance fluorescence (RF) in both systems, allowing experiments to be carried out at very low [0]. Secondary reactions were averted in this way, and the rate data thus obtained were stoichiometry-free. The DF-RF experiments were performed over the temperature range, 427-922K. Over the common range of temperature the absolute rate constants were in excellent agreement. The combined set of data from 415-922K is well described by $k_1 = (1.52 +- 0.28) x 10^{-10}$ exp (-7143 +- 196/RT) cm^3 $molecule^{-1}$ s^{-1} where R is expressed in cal $mole^{-1}$ K^{-1} and the errors are taken at the two standard deviation level (95% confidence). The bond energy-bond order (BEBO) method along with activated complex theory was applied to the title reaction, and satisfactory agreement with experimental rate constants was obtained.

57688 (DOE/ER/05015—4-Pt.1) **Mechanism of gas permeation through polymer membranes. Part I. Pure gases. Comprehensive progress report.** Stern, S.A.; Kulkarni, S.S.; Mauze, G.R. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). Jul 1982. Contract AC02-78ER05015. 185p. NTIS, PC A09/MF A01. Order Number DE82019917.

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The objective of this study is to assess the validity of a free-volume model of gas permeation through nonporous polymer membranes. This model provides a formalism for the prediction of permeability coefficients for pure gaseous penetrants and their mixtures as a function of both pressure and temperature. Such information is of great importance for the development of new, energy-efficient membrane processes for the separation of gas mixtures. Diffusion and solubility coefficients for Ar, CO_2, CH_4, C_2H_4, C_3H_8, and SF_6 in polyethylene membranes and rods have been measured in the temperature range from 5° to 50°C and at pressures up to 40 atm. under isothermal-isobaric conditions. It was found that the dependence of the diffusion and permeability coefficients on penetrant gas pressure and on temperature is satisfactorily represented by Fujita's free-volume model for the transport of small molecules in polymers and by its extension to gas permeation. The free-volume model of gas permeation relates permeability coefficients for gases in polymers to three thermodynamic variables, namely, temperature, pressure, and penetrant concentration, and to three characteristic parameters denoted A/sub d/, B/sub d/, and γ. Semi-empirical correlations were developed for these parameters as a function of physicochemical properties of the penetrant and the polymer. These correlations were obeyed by the gas-polyethylene systems studied in the present work. A generalized correlation was found for B/sub d/ values of penetrants of various molecular sizes in polyethylene, polybutadiene, poly(vinyl acetate), poly(methyl acrylate), silicone rubber, and natural rubber.

57689 (DOE/ER/05015—4-Pt.2) **Mechanism of gas permeation through polymer membranes. Part II. Gas mixtures. Comprehensive progress report.** Stern, S.A.; Mauze, G.R.; Kulkarni, S.S. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). Jul 1982. Contract AC02-78ER05015. 48p. NTIS, PC A03/MF A01. Order Number DE82019918.

The specific objective of this study is to assess the validity of a free volume model for the permeation of mixtures. This model provides a formalism for the prediction of permeability coefficients for the components of permeating mixtures, as well as of the dependence of these coefficients on pressure and temperature. Steady-state permeability coefficients were measured for equimolar mixtures of CO_2-C_2H_4, CO_2-C_3H_8, and C_2H_4-C_3H_8, as well as for a mixture of 74.9 mole % CO_2-25.1 mole % C_2H_4, in polyethylene membranes. The measurements were made at 20°, 35°, and 50°C and at pressures of up to 18 atm. In all cases, the permeability coefficients for the components of these mixtures were higher, and in some cases considerably higher, than the permeability coefficients for the pure components at comparable partial pressures and temperatures. Each component of the binary mixtures studied had thus the effect of increasing the permeability coefficients for the other components. Furthermore, at equal partial pressures and at the same temperature, the component exhibiting the highest solubility in the polymer had the largest effect in increasing the permeability coefficient of the other component. This behavior is in complete agreement with the predictions of the free-volume model for mixtures. From a quantitative viewpoint, the permeability coefficients for the components of the mixtures agreed, on the average, to better than 25% with the experimental values, the former being usually lower than the latter. The theoretical permeability coefficients can be estimated from the model using parameters determined with the pure components only. The extension of the model to multicomponent mixtures is straightforward.

57690 (INIS-SU—86, pp 335-336) **Synthesis and properties of new polyfunctional macrocyclic ligands.** Bogatskij, A.V.; Luk'yanenko, N.G. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57691 (ORNL/TM—8321) **Diffuse reflectance infrared Fourier-Transform spectra of selected organic compounds.** Harmon, S.H.; Caton, J.E. (Oak Ridge National Lab., TN (USA)). May 1982. Contract W-7405-ENG-26. 99p. NTIS, PC A05/MF A01. Order Number DE82015855.

Portions of document are illegible.

Diffuse reflectance infrared spectra of a variety of different organic compounds have been determined. Profiles of the spectra along with the location and relative intensity of the principal bands have been included for each compound studied. In addition both diffuse reflectance and transmittance infrared spectra were obtained for the same samples, and the spectral results were compared. Although some minor variations are observed between a diffuse reflectance spectrum and the corresponding transmittance spectrum, the diffuse reflectance is quite useful and may be a superior technique for the study of many samples because it possesses an inherently higher signal-to-noise response, requires less sample preparation and allows a very wide range of samples (solids, liquids of low volatility, neat sample, or sample diluted in a reflecting medium) to be studied under very similar conditions.

57692 **High-pressure NMR study of dynamical effects on conformational isomerization of cyclohexane.** Hasha, D.L. (Osaka Univ., Japan); Eguchi, T.; Jonas, J. *Journal of the American Chemical Society;* **104**: No. 8, 2290-2296(21 Apr 1982). Contract AC02-76ER01198.

The effect of temperature and pressure on the conformational inversion of cyclohexane in solution has been investigated with use of ^1H FT NMR spectroscopy. The solvents used in this study are methylcyclohexane-d_{14}, carbon disulfide, and acetone-d_6. The activation parameters as obtained from the temperature dependence of the rate constant are independent of solvent. However, the coalescence temperature in the methylcyclohexane-d_{14} solvent is 1.5°C higher than in the other two solvents. It is observed that the ring inversion in cyclohexane is accelerated when pressure is increased, and this pressure dependence of the rate constant is nonlinear. In the lower viscosity solvents, acetone-d_6 and carbon disulfide, the rate constant shows a larger pressure dependence than in the more viscous methylcyclohexane-d_{14} solvent. The experimental data are interpreted with use of results of the stochastic models for isomerization reactions. In these models it is proposed that there are dynamical effects on isomerization because the reaction coordinate is coupled to the surrounding medium. We find that the observed activation volume is strongly pressure and solvent dependent as is the collisional contribution to the activation volume. Since the collision frequency reflecting the coupling of the reaction coordinate to the solvent mediums is proportional to solvent viscosity, the observed activation volume and the transmission coefficient kappa correlate well with the solvent viscosity. In addition, the experimental data indicate a non-monotonic transition between the inertial (weak coupling) and diffusive (strong coupling) regimes of isomerization reactions. Our results represent the first experimental proof of the predictions of stochastic models for isomerization reactions in condensed phases. 9 figures, 1 table.

57693 Syntheses and electronic structures of decamethylmetallocenes. Robbins, J.L.; Edelstein, N.; Spencer, B.; Smart, J.C. *Journal of the American Chemical Society;* **104**: No. 7, 1882-1893(7 Apr 1982). Contract W-7405-ENG-48.

The synthesis of the $(Me_5Cp)_2M$ (M = Mg, V, Cr, Co, and Ni) and $[(Me_5Cp)_2M]PF_6$ (M = Cr, Co, and Ni) compounds are described. A preparative route to a novel, dicationic decamethylmetallocene, $[(Me_5Cp)_2Ni](PF_6)_2$, is reported. Physical measurements indicate that all the above compounds are D/sub 5d/ or D/sub 5h/ decamethylmetallocenes with low-spin electronic configurations. The decamethylvanadocene cation is apparently coordinatively unsaturated. A paramagnetic acetonitrile complex, $[(Me_5Cp)_2V(NCCH_3)]PF_6$, and a diamagnetic dicarbonyl derivative, $[(Me_5Cp)_2V(CO)_2]PF_6$, of the cation can be prepared, but pure $[(Me_5Cp)_2V]PF_6$ has not been isolated. Cyclic voltammetry studies verify the reversibility and the one-electron nature of the $(Me_5Cp)_2M$ reversible $[(Me_5Cp)_2M]^+$ (M = Cr, Fe, Co, and Ni) and $[(Me_5Cp)_2\ Ni]^+$ reversible $[(Me_5Cp)_2Ni]^{2+}$ redox reactions and show that the neutral decamethylmetallocenes are much more easily oxidized than their metallocene counterparts due to the electron-donating properties of the methyl groups. Magnetic susceptibility and EPR studies indicate the following ground-state assignments for the paramagnetic decamethylmetallocenes: ^{4}A/sub 2g/ ^{2}a/sub 1g/^{1}] for the 15-electron compounds $(Me_5Cp)_2V$ and $[(Me_5Cp)_2Cr]^+$, ^{3}E/sub 2g/[e/sub 2g/^{3}a/sub 1g/^{1}] for the 16-electron compounds $(Me_5Cp)_2Cr$ and $[(Me_5Cp)_2Mn]^+$, ^{2}E/sub 2g/[e/sub 2g/^{3}a/sub 1g/^{2}] for the 17-electron compound $[(Me_5Cp)_2Fe]^+$, ^{2}E/sub 1g/[e/sub 2g/^{4}a/sub 1g/^{2}e/sub 1g/^{1}] for the 19-electron compounds $(Me_5Cp)_2Co$ and $[(Me_5Cp)_2Ni]^+$, and ^{3}A/sub 2g/[e/sub 2g/^{4}a/sub 1g/^{2}e/sub 1g/^{2}] for the 20-electron compound $(Me_5Cp)_2Ni$. The uv-visible absorption spectra of the 15-, 18- and 20-electron decamethylmetallocenes are also reported.

57694 Pyridine coordination chemisry of nickel and platinum surfaces. Wexler, R.M.; Tsai, M.C.; Fried, C.M.; Muetterties, E.L. (Lawrence Berkeley Lab., CA). *Journal of the American Chemical Society;* **104**: No. 7, 2034-2036(7 Apr 1982).

Isotopic labelling studies have been used to provide fundamental understanding of the reactions of pyridine on various crystal planes of Ni and Pt. Ultrahigh vacuum studies indicated interaction via α-pyridyl bonding for some of the crystal planes. Reactions for pyridine complexes of the metals with hydrogen and deuterium were established as an H-D exchange process. (BLM)

57695 Orbital rotation in the lowest triplet state of benzophenone. Dinse, K.P. (Max-Planck-Institut fuer Medizinische Forschung, Heidelberg, West Germany); Pratt, D.W. *Journal of the American Chemical Society;* **104**: No. 7, 2036-2038(7 Apr 1982).

Optically detected magnetic resonance (ODMR) and electron-nuclear double resonance (ODENDOR) spectroscopy at both zero and high magnetic fields were used to examine single crystals of 4,4'-dibromodiphenyl ether (DOE) containing 0.1 mol % of an enriched perdeuterio [^{17}O] benzophenone (^{17}O-BP-d_{10}) guest. Representative spectra are presented and explanations are offered for the electron spin transitions. The summarized results indicate the currently used atomic orbital functions do not provide an accurate description of the lowest excited states of many aromatic carbonyls. (BLM)

57696 Reaction of isopropyl(pentaaquo)chromium(III) ion with molecular oxygen in aqueous solution: kinetics of the chain reaction and effects of chain-breaking reagents and of variable ionic strength. Ryan, D.A.; Espenson, J.H. (Iowa State Univ., Ames). *Journal of the American Chemical Society;* **104**: No. 3, 704-712(10 Feb 1982). Contract W-7405-ENG-82.

The reaction referred to in the title occurs according to the idealized stoichiometry $(H_2O)_5CrCH(CH_3)_2^{2+} + 0_2 + H^+ = Cr(H_20)_6^{3+} + (CH_3)_2CO$, although smaller amounts of $HCrO_4^-$, $Cr_2(OH)_2^{4+}$, and $(CH_3)_2CHOH$ are also formed. The rate of reaction is given by $-d[CrCH(CH_3)_2^{2+}]/dt = k[CrCH(CH_3)_2^{2+}]^3/^2$, with k = 0.49 +- 0.06 $M^{-1}/^2\ s^{-1}$ at 25.0°C and 1.0 M ionic strength, independent of $[0_2]$ and $[H^+]$ (0.003 to 0.1 M). The kinetics are consistent with a chain mechanism initiated by unimolecular homolysis of $CrCH(CH_3)_2^{2+}$ (k/sub H/ = 1.78 +- 0.11) x $10^{-4}\ s^{-1}$). The preferred mechanism is the one consistent with the striking inhibition by Fe^{2+} or high concentrations of Cu^{2+}, 0.02 to 0.40 M; in the latter case the rate law for the chain reaction becomes $-d[CrCH(CH_3)_2^{2+}][O_2][Cu^{2+}]^{-1}$. In this chain mechanism, $(CH_3)_2CH$(R) and $(CH_3)_2CHOO$(ROO) are the chain-carrying intermediates. One propagation step is the biomolecular (S/sub H/2) displacement of R by ROO through attack at the metal center of the organochromium complex. The rate of reaction is unchanged by addition of the inert electrolytes lithium perchlorate or perchloric acid in the range of ionic strength 0.0033 to 0.043 M. This effect, supports the mechanism above and rules out a kinetically equivalent mechanism in which the chain-carrying intermediates are Cr^{2+} and CrO_2^{2+}. The latter mechanism can also be ruled out on other grounds, including the failure of the independently prepared CrO_2^{2+} to react with Cu^{2+}. 4 figures, 5 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 57036, 57160, 57407, 57696

4005 Photochemistry

REFER ALSO TO CITATION(S) 57577, 57677, 57680, 57687, 57708, 57723

57697 (EUR—7592-EN) Mutual orientation of pigments in photosystem I particles from green plants. Junge, W.; Schaffernicht, H.; Nelson, N. (Commission of the European Communities, Brussels (Belgium)). 1981. 24p. Commission of the European Communities, Brussels, Belgium.

The mutual orientation of pigments in photosystem I reaction centers from spinach is evaluated by polarized photochemistry. The photoinduced linear dichroism of the absorption changes of chlorophyll-asub(I) at 701 nm is studied as function of the excitation wavelength. The photosystem I reaction center particles contain about 100 and if depleted about 40 chlorophylls, respectively. To prevent their rapid Brownian rotation they were immobilized on DEAE sephadex. It is observed that the dichroic ratio of the absorption changes of chlorophyll-asub(I) does not exceed a figure of 4/3, which characterizes a circularly degenerate system, even at excitation at 724 nm. This excitation selectively hits the few chlorophyll-a molecules absorbing at about 700 nm (includign the photooxidizable dimer). Therefore we conclude, the dimer is either composed of two chlorophyll-a molecules with their y-axes perpendicular, or, if these are in parallel, there is another pair absorbing at the same wavelength with its y axes perpendicular to those of the oxidizable dimer.

57698 (EUR—7609-DE) Investigations into the oxidation of water and the reduction of nitrogen by photochemically generated redox-couples. Radebold, R.; Seiler, W. (Commission of the European Communities, Brussels (Belgium)). 1981. 125p. Commission of the European Communities, Brussels, Belgium.

By illumination of molten Na_2O-NaOH binary mixtures at temperatures about 350°C which absorb light in two bands of about 470 nm and 880 nm respectively, both Na_2O_2 dissolved in the melt and solid NaH are produced by a photochemical oxidation-reduction-reaction. The back-reaction of the photo-process is apparently blocked to a large extent. There are indications that the melt has an internal structure similar to that of molten alkali-halides and is acting like a photosynthetic membrane due to its holes, which are trapping electrons generated by photolysis of NaO^- for the subsequent reactions, necessary to form NaH. By using both photoproducts Na_2O_2 and NaH as electron-proton-acceptor and electron-proton-donor, in dark reactions water is splitted and molecular nitrogen is fixed, in form of a stable intermediate N-compound, and, in a subsequent step, transferred into hydrazine. The intermediate N-compound is sodium-amide $NaNH_2$.

57699 (LBL—14673) Energy interactions and phospholipid vesicles. Baker, D.E. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract AC03-76SF00098. 55p. NTIS, PC A04/MF A01. Order Number DE82019301.

Thesis.

Luminescence quenching studies of unilamellar phosphatidylcholine vesicles containing a surfactant sensitizer derived from tris(2,2'-bipyridine)ruthenium(II) have shown that only a fraction of these sensitizers is quenchable when ferricyanide is added to the continuous aqueous phase, and that this fraction is made up exclusively of the sensitizers located in the outer monolayer. The size of this fraction is independent of the sensitizer concentration. In contrast to this, the quenching rate constant increases with sensitizer concentration. From these observations, one can conclude that energy transfer occurs among sensitizers located on the same surface of a vesicle, but energy transfer between these sensitizers is not long range enough to reach efficiently across the membrane from inside to outside (and vice versa). The existence of this energy transfer in the first case has important implications on the kinetic scheme for photosensitized electron transport reactions through vesicle walls. The size of the vesicles studied was determined to be ~ 500 angstroms in diameter by ^{14}C-sucrose entrapment. This experimental finding in addition to the fixed fraction of quenchable fluorescence of 0.67 +- 0.02 implies that the surfactant ruthenium molecules extend a considerable distance out of the vesicle into the aqueous phase, and/or they are asymmetrically distributed between inner and outer vesicle surfaces.

57700 Photoionization mass spectrometry of NH_2OH: Heats of formation of HNO^+ and NOH^+. Kutina, R.E.; Goodman, G.L.; Berkowitz, J. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* 77: No. 4, 1664-1676(15 Aug 1982). Contract W-31-109-ENG-38.

Energy-dependent mass spectra are presented for the most prominent ions produced upon photoionization of hydroxylamine. Two distinct thresholds are oberved for mass 31, which we attribute to onsets for formation of HNO^+ and NOH^+. The corresponding heats of formation are ΔH⁰/sub f/,0 (HNO^+) = 256.8 +- 1.4 kcal/mol and ΔH⁰/sub f/,0 (NOH^+) = 274.8 +- 0.7 kcal/mol. The thresholds for mass 32, which we tentatively ascribe to H_2NO^+, corresponds to 224.6 +- 0.2 kcal/mol for its heat of formation. Each of these entities can therefore be produced in an exothermic reaction of $H^+{}_3$ with NO, and represent mechanisms for depleting NO in the interstellar clouds. Experimental breakdown diagrams are generated and compared with predictions of QET. It is found necessary to invoke a three-body decomposition to explain some observations at higher energy. A theory is presented to accommodate this process within the framework of QET.

57701 Benzoquinone quenching of diporphyrin excited states: kinetic evidence for distinguishing electron-transfer photoproducts from (π,π^*) states. Netzel, T.L. (Brookhaven National Lab., Upton, NY); Bergkamp, M.A.; Chang, C.K. *Journal of the American Chemical Society;* **104**: No. 7, 1952-1957(7 Apr 1982).

Previous spectroscopic work on a doubly linked cofacial diporphyrin, Mg-H_2(5), comprised of magnesium porphyrin and free-base porphyrin subunits provided optical evidence consonant with rapid ($> 10^{11}\ s^{-1}$) light-driven electron transfer (ET) between the subunits in CH_2Cl_2 and $^1(\pi,\pi^*)$ excited state formation in tetrahydrofuran (THF). Data reported herein for the spectral and kinetic results due to quenching the excited states of Mg-H_2(5) in these two solvents by the addition of iodobenzene and p-benzoquinone confirm the excited state assignments suggested earlier. A working model of excited state couplings for Mg-H_2(5) in CH_2Cl_2 is reported to account for the rapidity ($> 10^{11}\ s^{-1}$) of the forward ET reaction and the slowness ($5 \times 10^9\ s^{-1}$) of the reverse one. Finally, the rates and thermodynamic efficiencies of these in vitro ET reactions are shown to compare favorably with those of the primary charge separations found in natural photosystems.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 56347, 57620, 58234, 58593

57702 (AD-A—110433/0) Nuclear transmutation doping of GaAs. Final technical report 1 Jun 80-30 Jun 81. Fritzsche, H. (Chicago Univ., IL (USA). James Franck Inst.). Sep 1981. 50p. NTIS, PC A03/MF A01.

Shallow donors have been introduced into GaAs crystals by irradiation with thermal neutrons and subsequent nuclear transmutation. Good agreement was found between the measured concentrations of added donors and the values expected from the neutron capture cross sections and the neutron fluences used. This doping method is approximately 1000 times more efficient in GaAs than in Si because of the higher abundances and neutron capture cross sections of the transmutable isotopes in GaAs. In epitaxially grown GaAs of high purity, the recoil and radiation damage associated with transmutation doping can be removed by annealing at about 600 C which is below the critical temperature for As effusion. The electronic transport properties of transmutation doped GaAs samples were studied between 1.4 and 450K of concentrations both above and below the metal-nonmetal transition. We found that transmutation doping is a convenient method for introducing a desired concentration of shallow donors into GaAs crystals for modifying their electronic properties.

57703 (AD-A—111661/5) Structure determination of the macromonomer poly(1,11-dodecadiyne) and its crosspolymerized product. Technical report 1 Mar 81-27 Jun 82. Lando, J.B.; Thakur, M. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Macromolecular Science). 27 Jun 1982. 25p. NTIS, PC A02/MF A01.

Electron diffraction patterns were obtained from the macromonomer and cross-polymerized crystals of Poly(1,11 Dodecadiyne). The macromonomer was cast in thin (< 200 A) films from chloroform solution. Crosspolymerization resulted from subsequent exposure of these samples to Co60 - gamma radiation. Two orientations of the crosspolymerized crystals were obtained by varying the evaporation rate of solvent in the original macromonomer diposition. Thirty-six reflections for the crosspolymerized sample and eighteen reflections for the macromonomer were obtained. Refinement of the structures was accomplished with these data. The unit cell of both macromonomer and crosspolymerized material was monoclinic, space group P2 sub 1 1n.

57704 (INIS-mf—7184) Contribution to radiation-chemically catalyzed hydroformylation of butenes in the presence of metal carbonyls. Joosten, L. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Jul 1976. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780732.

Thesis.

In this paper a study is presented of the influence of gamma-radiation on the catalytic hydroformylation of olefines. As model olefines buten-1 and buten-2 as well as their mixtures have been used together with the catalysts di-cobalt octacarbonyl and rhodium (I) tristri phenyl-phosphine carbonyl hydride. In addition the catalytic activity of the VI. side group carbonyles Cr(CO)$_6$, Mo(CO)$_6$ and W(CO)$_6$ has been studied under radiation chemical conditions. For this purpose a mixture of olefine, solvent (cyclohexane) and catalyst has been pressurized and processed in a mixing autoclave together with a Co and H$_2$ (1:1) mixture, varying the reaction variables within certain limits.

57705 (INIS-mf—7186) **Influence of gamma radiation reaction on the hydroesterification of butenes catalyzed by metal carbonyls.** van der Velde, J. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Jul 1976. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780730.

Thesis.

In the hydro carboxylation reaction, which first has been studied by Reppe, olefine and acetylene compounds are processed with carbon monoxide and water at high pressures and high temperatures in the presence of metal carbonyls. This reaction can be enhanced considerably by application of ionizing radiation. Lower pressures and in particular lower temperatures can be used if gamma irradiation is performed during carboxylation. For the experiments a mixture of buten-1 and buten-2 as well as pure buten-1 and pure buten-2 has been used to study the behaviour of these olefines with respect to the isomerization of the reaction products and to the olefines not transformed in the reaction process. Replacing water, methanol has been used as a reaction component, thus obtaining directly the respective carbonyl acid esters, which can be analysed quantitatively and qualitatively with respect to their isomeric composition by gas chromatography.

57706 (INIS-SU—86, pp 146-147) **Radiochemistry of positron and positronium and its physicochemical applications.** Gol'danskii, V.I.; Shantarovich, V.P.; Onishchuk, V.A.; Aravin, L.G. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57707 (INIS-SU—86, pp 152) **Influence of radiolytic effects on oxidation-reduction states of plutonium and neptunium in nitric acid.** Vladimirova, M.V.; Kulikov, I.A.; Sosnovskii, O.A.; Milovanova, A.S. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57708 **Fast reaction studies of rhenium carbonyl complexes: the pentacarbonylrhenium(0) radical.** Meckstroth, W.K. (Ohio State Univ., Columbus); Walters, R.T.; Waltz, W.L.; Wojcicki, A.; Dorfman, L.M. *Journal of the American Chemical Society;* **104**: No. 7, 1842-1846(7 Apr 1982). Contract AC02-76ER01763.

The Re(CO)$_5$ radical has been generated in the pulse radiolysis of a variety of organorhenium compounds in ethanol solution as well as in the flash photolysis of Re$_2$(CO)$_{10}$ in isoctane solution. This radical exhibits an optical absorption band in the visible region with a maximum at 535 nm and a molar extinction coefficient, in ethanol, of ϵ_{535} 1000 +- 100 M^{-1} cm^{-1}. Absolute rate constants were determined for the reactions of the solvated electron, in ethanol, with Re(CO)$_5$Br (6.7 x 10^9), Re(CO)$_5$SO$_2$CH$_3$ (6.6 x 10^9), and Re$_2$(CO)$_{10}$ (7.8 x 10^9 M^{-1} s^{-1}). Rate constants were also obtained for the reactions of Re(CO)$_5$ and of Mn(CO)$_5$ in abstracting a chlorine atom from carbon tetrachloride in ethanol solution. The values, at 22°C, are 3.9 x 10^7 and 6.1 x 10^5 M^{-1} s^{-1}, respectively, indicating a 65-fold higher reactivity for the pentacarbonylrhenium radical as compared with the pentacarbonylmanganese radical in this abstraction reaction. The rate constant for the recombination reaction of Re(CO)$_5$ radicals in isooctane was found to be $2k_7 = 5.4 \times 10^9$ M^{-1} s^{-1}.

57709 **Delocalized π radical cations of acetals.** Snow, L.D.; Wang, J.T.; Williams, F. (Univ. of Tennessee, Knoxville). *Journal of the American Chemical Society;* **104**: No. 7, 2062-2064(7 Apr 1982).

Examples are presented which illustrate the theory that in a radical cation containing two equivalent oxygen atoms separated by a bridging methylene group, the spin is delocalized in a three-centered [-O-CH$_2$-O-] π orbital. The radicals were generated by γ radiation of solid solutions of 1,3-dioxacyclopentane, 1,3-dioxacyclohexane, s-trioxane, 2,5-dimethoxytetrahydrofuran, and dimethoxymethane in a Freon matrix. The reaction mechanism for radical production is positive charge transfer from the solvent to the solute. The ESR spectra of the radical cations are presented and discussed in some detail. (BLM)

57710 **Studies on spin-trapped radicals in γ-irradiated aqueous solutions of L-alanylglycine and L-alanyl-L-alanine by high-performance liquid chromatography and ESR spectroscopy.** Moriya, F.; Makino, K.; Suzuki, N.; Rokushika, S.; Hatano, H. (Kyoto Univ., Japan). *Journal of the American Chemical Society;* **104**: No. 3, 830-836(10 Feb 1982).

Aqueous solutions of L-alanylglycine and L-alanyl-L-alanine were γ irradiated in the presence of a spin trap, 2-methyl-2-nitrosopropane. Stable sspin adducts produced in the γ-irradiated solutions were analyzed by high-performance liquid chromatography and ESR spectroscopy. The following spin adducts were found and identified: t-BuN(O)CH-(CH$_3$)CONHCH$_2$COO$^-$ (I), NH$_3^+$-*CH(CH$_3$)CONH-*CH(COO$^-$)N(0)-t-Bu (II), and t-BuN(0)CH$_2$CH(NH$_3^+$)-CONHCH$_2$COO$^-$ (III) from L-alanylglycine; t-BuN(0)-*CH(CH$_3$)CONH-*CH(CH$_3$)COO$^-$ (IV), NH$_3^+$-*CH(CH$_3$)-CONH-*C(CH$_3$)(COO$^-$)N(0)-t-Bu (V), NH$_3^+$CH(CH$_3$)CONHCH(COO$^-$)CH$_2$N(O)-t-Bu (VI), and t-Bu-N(0)-CH$_2$CH(NH$_3^+$)CONHCH(CH$_3$)COO$^-$ (VII) from L-alanyl-L-alanine. Each of sspin adducts II, IV, and V was found as a pair of diastereomeric radicals, which revealed mutually different hyperfine splitting constants. The two diastereomeric pairs of spin adducts II and V were individually separated. It was demonstrated that ESR spectra of spin adducts II, III, and VI changed remarkably with pH through the acid-dissociation equilibria of the carboxyl or amino groups. The pK/sub a/ values for the dissociation have been determined to be 1.8 and 1.6 for the carboxyl groups of the pair of diastereomeric pin adducts II. The pK/sub COOH/ values are lower than that of alanylglycine because of the electron-withdrawing character of the nitroxyl group. 12 figures, 2 tables.

57711 (PB—82-168006) **Novel diaphragm for electrolytic cells. Final report.** (Commission of the European Communities, Luxembourg). 1981. Translation of EUR-7023FR. 83p. NTIS, PC A05/MF A01.

The basic intent of these studies is to produce a diaphragm permeable to two types of ions, which have properties which are similar to those of asbestos. PTFE in the form of fabric is rendered hydrophilic by grafting monomer acrylic acid by a radio-chemical technique; two methods were utilized to do this: - Direct radiochemical method under radiation - Pre-irradiation method in air under radiation and accelerated electronic radiation. The monomer acrylic acid was grafted in the presence or non-presence of crosslinking agents, the latter before developing a resistance derived from the diaphragms obtained at the agressivity of the medium in which they would be utilized (potassium hydroxide 40%, 200 degrees C under electrolysis).

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 57624, 57629, 57634, 57647, 57658, 57707

57712 (CEA-CONF—5904) **Transuranium element chalcogenides. Crystallochemistry and Moessbauer spectrometry of neptunium 237 chalcogenides.** Thevenin, T.; Pages, M.; Damien, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). Sep 1981. 19p. (In French). (CONF-8109145—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702338.

From CNRS international symposium on chemistry and physics of sulfides, selenides and tellurides in the solid state; Paris, France (14 Sep 1981).

To study actinide compounds , neptunium 237 has been studied by Moessbauer resonance. The different oxidation degrees of neptunium (7, 6, 5, 4 and 3) have a very important effect on isomeric displacements. In the study of chalcogenides, the isomeric displacement value of NpS_3 confirms the valency 4+ of neptunium in this compound. Results obtained with Np_3S_5 show two valency state +3 and +4 in this compound. There is a good agreement with the two crystalline sites determined by crystallography.

57713 (INIS-mf—7059-Vol.2, pp vp) **After-effects of electron capture of ^{57}Co in frozen aqueous solutions of $^{57}CoCl_2$.** Mulhem, J.K.; Horvath, D.; Molnar, B.; Nagy, D.L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1981. NTIS (US Sales Only), PC A22/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Moessbauer spectra of ^{57}Co in dilute frozen aqueous solutions of $^{57}CoCl_2$ and in 0.11 at.% frozen aqueous solutions of $CoCl_2$ with and without glass former have been studied. The spectra reveal the presence of a small fraction of Fe^{3+} ions, in addition to the Fe^{2+} as a consequence of the Auger cascade following the electron capture. The quadrupole splitting of the ferrous ions was found to be less by 13% than that of the $Fe(H_2O)_6{}^{2+}$ complex as measured in absorption geometry. This is suggested to be the consequence of the autoradiolysis of water molecules resulting in a metastable state of the complex.

57714 (INIS-SU—86, pp 71) **Chemical synthesis with participation of monatomic gases.** Legasov, V.A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57715 (INIS-SU—86, pp 144) **Synthesis and search of superheavy elements.** Flerov, G.N. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57716 (INIS-SU—86, pp 145) **Technetium is a new radioactive metal of technics (chemistry, technology, practical uses).** Spitsyn, V.I. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57717 (INIS-SU—86, pp 147-148) **Problems of chemical identification of new synthetic elements.** Zvara, I. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57718 (INIS-SU—86, pp 148) **Preparation of transuranium elements in new higher oxidative states by means of beta-decay.** Peretrukhin, V.F.; Kosyakov, V.N.; Erin, E.A.; Krot, N.N. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57719 (INIS-SU—86, pp 149) **Peculiarities of behavior of americium and neptunium ions in the strongly complexing medium ($K_{10}P_2W_{17}O_{61}$).** Erin, E.A.; Kopytov, V.V.; Vasil'ev, V.Ya.; Rykov, A.G. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57720 (INIS-SU—86, pp 150) **Physicochemical properties of monovalent mendelevium and its chloride.** Spitsyn, V.I.; Mikheev, N.B.; Kamenskaya, A.N.; Berdonosov, S.S.; Mikul'skii, Ya. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57721 (INIS-SU—86, pp 150-151) **New investigations in the field of kinetics and mechanism of neptunium and plutonium reactions.** Koltunov, V.S.; Frolov, K.M.; Marchenko, V.I.; Tikhonov, M.F.; Zhuravleva, G.I.; Kulikov, I.A.; Ryabova, A.A. 1981. (In Russian). NTIS (US Sales Only), PC A20/MF A01.

In Neorganical chemistry and technology of neorganic substances: radiochemistry, analytical chemistry, coordination chemistry. Annotations of reports and communications. No. 1.

57722 (JEN—479) **Preparation of a lipopolysaccharide from Escherichia coli olIIa, olIIb, K58: H21 bacterial wall, labeled with carbon-14.** Solano, M.L.; Pacheco, J.; Garcia, M.D. (Junta de Energia Nuclear, Madrid (Spain)). 1981. 96p. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82902830.

Portions of document are illegible.

A brief description of the morphological and chemical structure of Lipopolysaccharides is given, as well as its occurrence in nature and its mechanisms of action. It is emphasized the usefulness for actual biochemical and biomedical research of the labeled Lipopolysaccharide. The method for the labelling, isolation, and purification of ^{14}C-Lipopolysaccharide is described.

57723 (RFP—3113) **Photochemical reactions in plutonium-nitric acid solutions.** Kazanjian, A.R. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 9 Dec 1981. Contract AC04-76DP03533. 8p. NTIS, PC A02/MF A01. Order Number DE82005852.

Plutonium in its various valence states in HNO_3 solutions was irradiated with ultraviolet-visible light and visible light. Oxidation was the only reaction; plutonium(III) was oxidized to plutonium(IV) and plutonium(IV) was oxidized to plutonium (VI). The oxidation of plutonium(IV) was dependent on the acid concentration and the spectral portion of the light source used. There was no reduction of plutonium(VI) in solutions with HNO_3 concentrations ranging from 0.5 to 7N. Plutonium polymer solutions also were irradiated with ultraviolet-visible light, which greatly accelerated the decomposition of both freshly formed and aged polymer.

57724 (SSA—1981-TS-2) **1980 Scientific works.** (Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France)). Aug 1981. 623p. (In French). NTIS (US Sales Only), PC A99/MF A01. Order Number DE82780717.

Selected papers were processed for inclusion in the Energy Data Base.

57725 **Synthesis, properties, and molecular structure of a trivalent organouranium diphosphine hydride.** Duttera, M.R. (Northwestern Univ., Evanston, IL); Fagan, P.J.; Marks, T.J.; Day, V.W. *Journal of the American Chemical Society;* **104**: No. 3, 865-867(10 Feb 1982).

Hydrogenolysis of $U[(CH_3)_5C_5]_2R_2$, $[R = CH_3Ch_2Si(CH_3)_3]$, proceeds at -20°C in the presence of excess bis(2 dimethylphosphino)ethane(dmpe) according to this reaction: $U[(CH_3)_3C_5]_2R_2 + 1.5H_2 + dmpe \rightarrow$ (toluene, 18h) $U[(CH_3)_5C_5]_2$(dmpe) H + 2RH. Black microcrystals can be purified by vacuum Soxhlet extraction with toluene. All processes involving this compound must be performed under argon or helium atmospheres, since it reacts with nitrogen. The structure was studied by NMR, ir spectra. The molar magnetic suceptibility was measured at 295 K, 5120×10^{-4} emu and is consistent with a U (III) formulation. Crystals are orthorhombic. X-ray diffraction data were collected. Structural parameters were refined to convergence. X-ray structural analysis reveals monocrystals of discrete mononuclear $U[eta^5\text{-}(CH_3)_5C_5]_2$ (dmpe)H molecules. The molecular structure is evaluated. 1 figure.

57726 **Method for determining carbonate complexes.** Nilsson, K.; Skytte Jensen, B. (Risoe National Lab., Roskilde (Denmark)). pp 55-64 of Techniques for identifying transuranic speciation in aquatic environments. Proceedings of a technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges: techniques for identifying the speciation, jointly organized by the IAEA and the CEC and held in Ispra, Italy, 24-28 March 1980. Vienna, Austria; IAEA (1981).

From Technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges; Ispra, Italy (24 Mar 1980).

This paper shows the value of liquid/liquid partitioning to determine the formation constants of bicarbonate and carbonate complexes of radionuclides. These constants are important to evaluate the rate of migration of complexed radionuclides that are in carbonate-saturated ground water. Experimental difficulties are discussed and reduced to provide laboratory approximations to these constants.

57727 **Techniques for identifying transuranic speciation in aquatic environments: proceedings.** Vienna, Austria; International Atomic Energy Agency (1981). vp. (CONF-8003172—).

From Technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges; Ispra, Italy (24 Mar 1980).

Selected papers are indexed separately.

57728 (INIS-mf—7117, pp vp) **Some recent developments in the chemistry of uranium and thorium. Trans effects in inorganic and organometallic complexes.** Bagnall, K.W. (Manchester Univ. (UK)). [nd]. NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

During the last decade, evidence for trans effects in uranium chemistry has been obtained for the recently discovered monoxoactinoid(VI) halocomplex anions, $[UOX_5]^-$ and $[(eta^5C_5H_5)UX_3L_2]$ complexes, where L is a neutral oxygen donor ligand. Evidence for these trans effects is presented in this review, together with a comparison with the behaviour of analogous d transition element complexes where possible, and this is followed by a very brief account of one of the highly interesting results reported by Marks and his co-workers at North Western University in Illinois on the chemical behaviour of sigma-bonded alkyl compounds of thorium(IV) and uranium(IV).

57729 (INIS-mf—7117, pp vp) **Investigations into the reaction behaviour of Usup(IV)- and Usup(VI)-salts compared to crown ethers in protic and aprotic solvents.** El Basyouny, A.; Knoechel, A.; Vollmer, H.J. (Hamburg Univ. (Germany, F.R.). Inst. fuer Anorganische und Angewandte Chemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

The stormy development of complex chemistry of macrocyclic polyethers in the last 10 years has developed into numerous newly developed complex compounds which are characterized by different variants of the binding interaction formed and the arrangement of the cations. Uranyl nitrate thus forms addition complexes together with different crown ethers with indirect interaction between cation and crown ether. The anions are always covalently bonded. NMR spectroscopy and IR spectroscopy and X-ray structure investigations are applied to clarify the structure of these compounds. Synthesis of other uranyl complexes, partly water-free ones, have been attempted or are planned. Synthesis tests with crown ether complexes of U(IV) have also been attempted with the aim of obtaining interstitial structures of UO_2^{2+} by oxidation.

57730 (INIS-mf—7117, pp vp) **Spectral-pure bis(phtalocyaninato) complexes of thorium(IV), protactinium(IV) and uranium(IV).** Lux, F.; Beck, O.F.; Krauss, H. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl und Inst. fuer Radiochemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

A new method has been developed to prepare spectrally pure bis(phthalocyaninato) actinoid(IV) complexes, particularly $PaPc_2$, starting with the iodide compounds $AnI_4 \times 4CH_3CN$. This method contains a sublimation purification step in a 2-stage temperature profile (500°C/350°C/room temperature). This ensures a clean separation of the free phthalocyanine which normally makes the interpretation of the electron spectra harder. The spectrally pure $AnPc_2$ complexes are generally extremely suitable for the investigation of the properties of the bis(phthalocyaninato) complexes.

57731 (INIS-mf—7117, pp vp) **Interpretation of splitting the main absorption bands of $AnPc_2$ complexes.** Krauss, H.; Beck, O.F.; Lux, F. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl und Inst. fuer Radiochemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

Taking the molecular structures into consideration as starting point, an attempt has been made to interpret the electron spectra of the bis(PC) actinoid(IV) complexes which characteristically have a shoulder on the longwave side of their main absorption bands. The exact position of the satellite bands (for UPc_2 a superimposition of several bands) is determined by comparing the spectra at room temperature and at 80 K and their 4th derivation. The low temperature measured results are compared to model calculations upon which the application of the dipole-dipole interaction or excitation theory on the band splitting is based. The mutual dependence of ligand torsional angle and intensity ratio main absorption bands:satellite bands are produced as satisfactory agreement between theoretically calculated and experimental values.

57732 (INIS-mf—7117, pp vp) **Organometallic chemistry in the field of transuranium elements: spectroscopy and magnetism.** Kanellakopulos, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

An attempt has been made to discuss and to show the features of the actinides compared to the lanthanides which based on magnetochemical and spectroscopical investigations, exhibit relationships between different properties which can contribute to a better understanding of the properties of the 4f and 5f elements. NMR and ESR electron spectroscopical measurements are used.

57733 (INIS-mf—7117, pp vp) **Chemical behaviour of elements in extremely small concentrations taking the example of polonium.** Trautmann, N.; Reischmann, F.J.; Rumler, B.; Herrmann, G. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

The chemical behaviour of polonium in the range of 10^8-10^5 atoms was investigated with ^{210}Po (Tsub(1/2) = 138.4 d) as indicator with electrochemical deposition, electrolysis, co-precipitation of tellurium or arsenic trisulphide, as well as in extraction chromatography with tri-n-butyl phosphate. All processes lead to a complete separation of polonium at these concentrations. The suitability of the chemical methods with ^{218}Po (Tsub(1/2) = 3.05 min), as well as the thermochromatographic down to 10^2 atoms are explored. Furthermore, tests with short-lived astate and technetium isotopes are intended.

57734 (INIS-mf—7117, pp vp) **Physical chemical state and the chemical and biological behaviour of plutonium at extremely low concentrations.** Aumann, D.C.; Muellen, G. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl und Inst. fuer Radiochemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

Radiochemical separation methods have been worked out in order to determine the oxidation state of Pu at low concentrations in aqueous solution. These methods are based on co-precipitation and solvent extraction. The possibility for the planned investigation using different Pu isotopes (Pu 236 to 242) enable exchange reactions between the single oxidation states to be traced and, due to the different specific activities, large concentration areas to be determined. The first application of the determination methods was to determine the oxidation states of the Pu ions which dissolve in small quantities when treating PuO_2 with solution containing carbonate.

57735 (INIS-mf—7117, pp vp) **Search for spontaneous fission in the Atlantis II.** Lund, T.; Tress, G.; Molzahn, D.; Brandt, R. (Marburg Univ. (Germany, F.R.). Fachgebiet Kernchemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

By measuring samples available over a long period of time, the upper limit for the maximum concentration on SHE in chemically enriched samples could be further reduced to: $<= 1.6 \times 10^{-14}$ g/g hence, samples subjected to a special form of enrichment are less than the 'Flerov' value by a factor 30. No SHE was found in the soluble salt (NaCl, etc.) of the hot brine. The main topic of the works during the period of the report when answering the question: can single spontaneous fission transuranium nuclides be responsible for 'Flerov's effect'. The provisional answers are: The following essential TU nuclides can't be: ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{244}Pu, ^{241}Am, ^{242}Cm, ^{244}Cm, ^{246}Cm, ^{247}Cm, ^{252}Cf (marginal). ^{248}Cm, ^{250}Cm, 'Unknown TPu isomers' are not clear. Further work is necessary in the years to come particularly on thoroughly chemically treated samples. One should also mention that other types of ^{3}He counter measurements would be useful.

57736 (INIS-mf—7117, pp vp) **New preparations for cyclotron radionuclide labelling in the development of radiopharmaceutics.** Kloster, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nuklearchemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

A survey is given on recent developments in the field of pharmaceutics. The main topics are organic products labelled with short-lived radionuclides for the in-vivo investigation of energy metabolism of the heart, particularly fatty acids labelled with radiohalides, and of the brain with ^{11}C and ^{18}F labelled glucose derivatives. Problems and future trends for manufacturing radionuclides and synthesis precursors, the labelling synthesis, as well as radiobiochemical investigations to first clinical tests are explained especially by means of research work done in the KFA Juelich.

57737 (INIS-mf—7117, pp vp) **^{18}F fluorination using macrocyclic polyethers.** Klatte, B.; Knoechel, A. (Hamburg Univ. (Germany, F.R.). Inst. fuer Anorganische und Angewandte Chemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

The aim of this work is the nucleophilic substitution labelling with ^{18}F with high selectivity and yield for a short reaction time. Labelling with little or no carrier presumes that ^{18}F is obtained in anhydrons form. Starting with the production via the nuclear reaction ^{20}Ne(d,α)^{18}F, the ^{18}F formed is to be continuously converted into an alkali polyether complex whose purpose is to increase the reactivity of the fluoride (compared to the non-complexed anion form), so that nucleophilic substitution reactions can be carried out faster and more carefully. A report is given on the working program and on first results to optimize the carrier-poor synthesis with polyethers as synthesis agent.

57738 (INIS-mf—7117, pp vp) **Problems in finding the structure of technetium compounds.** Molter, M. (Hoechst A.G., Frankfurt am Main (Germany, F.R.)). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

Tc radiodiagnostics are used in nuclear medicine for the most different investigations. The oxidation states of Tc are unclear, as well as the structure of the organic compounds used and their pharmaceutical effect. The problems still open in certain manufactures and uses are illustrated by numerous examples.

57739 (INIS-mf—7117, pp vp) **Preparation and application of technetium compounds in nuclear medicine.** Bremer, K.H. (Hoechst A.G., Frankfurt am Main (Germany, F.R.)). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

A general survey is given on the Tc compounds coming into use in medical diagnostics (for liver, spleen, lungs, brain, circulation, kidneys, skeleton). Nuclear medical diagnostic techniques can be improved upon by specific chemical changing of the basic structures of the preparates used sofar. This is shown in 2 examples: 1) the change of the acetanilido-iminoacetate used for liver function diagnostics and 2) the change of the phosphonates used for skeleton scintiscanning.

57740 (INIS-mf—7117, pp vp) **γn-recoil produced compounds.** Sattler, E.L. (Giessen Univ. (Germany, F.R.). Strahlenzentrum). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

The utilization of a 65-MeV electron linear accelerator to produce ^{11}C and ^{15}O for the manufacture of pharmaceutically interesting preparates is described. It is important here to separate compounds formed by direct recoil labelling using a highly effective method (high voltage electrophoresis, chromatographic methods). The winning of ^{11}C amino acids, the photosynthetically used ^{11}CO formation from a gas target to produce saccharose, as well as the production and separation of $^{15}O_2$ are given (e.g. the measurement of aerobic metabolism selectivities).

57741 (INIS-mf—7117, pp vp) **Chemical consequences of Br(n,γ), Br(γ,2n), Os(n,γ) and Os(γ,n) nuclear processes in mixed potassium hexabromchloro-osmates(IV), K_2OsBr/sub n/Cl/sub 6-n/.** Mueller, H.; Bekk, P. (Freiburg Univ. (Germany, F.R.). Inst. fuer Radiochemie). [nd]. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Status report 1980 of the scientific sector 'Nuclear Chemistry' promoted by the BMFT (Federal Ministry for Research and Technology).

Hexabromochloro-osmates(IV), OsBr/sub x/Cl/sub 6-x/$^{2-}$, preferably labelled with bromium or osmium are produced in mixed ligand complex salts of the series K_2OsBr/sub x/Cl/sub 6-x/ with x = O....6 as product of the nuclear reactions ^{81}Br(n,γ)^{82}Br, ^{79}Br(γ,2n)^{77}Br, ^{184}Os(n,γ)^{185}Os, ^{190}Os(n,γ)^{191}Os, ^{186}Os(γ,n)^{185}Os and ^{192}Os(γ,n)^{191}Os; the former are quantitatively determined. The results of the (γ,xn) nuclear reactions agree with the hot-spot statistics. The recoil substituted target anions are preferably found in the (n,γ) reactions with low recoil energies. The distribution of the recoil species can be interpreted using simple mechanism models. Contrary to the view maintained sofar, there is an influence of the initial energy of the recoil atom on its ultimate destiny.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 56446

57742 (AD-A—109060/4) **Multiangular scanning absorption-emission techniques for three dimensional combustion diagnostics. Annual report 1 Sep 80-30 Aug 81.** Goulard, R. (George Washington Univ., Washington, DC (USA). School of Engineering and Applied Science). 1 Dec 1981. 14p. NTIS, PC A02/MF A01.

This program explores the potential of absorption techniques for low ppm, real time, 3-dimensional combustion diagnostics. In the current phase of activity, a laser beam has been transformed into a sheet of light and made to converge on a 126-element array, with electronics suitable for repeatable 1.5 KHz scanning and data processing. Available memory modules (4K) allow for 34 successive slicings of a passing target within 20 milliseconds. In this manner, a detailed projection of three-dimensional flow field concentrations is available. An axisymmetrical flow (tobacco smoke rings) has been measured and a tomographic procedure was applied to these data. Better ranges of absorption are being considered and multiangular experiments (non-symmetrical cases) will follow. The construction of a portable tomographic unit is also in progress. It was upgraded to nonsteady flow capabilities by coupling a CAMAC digitizer with a MINC minicomputer. The source and sensor part of the experiment have been completed. Data processing and flow controls will follow. A theoretical review of flow instabilities is underway. Existing qualitative work suggests three-dimensional patterns for which this tomographic approach is ideally suited.

57743 (AD-A—109947/2) **Fluid dynamics-reactive flow modeling. Final report.** Hyman, E.; Fry, M.; Tittsworth, J.; Fyfe, D.; Kailasanath, K. (Science Applications, Inc., McLean, VA (USA)). 16 Dec 1981. 92p. (SAI—82-655-WA). NTIS, PC A05/MF A01.

This work includes (1) adaptations of the FAST2D code for slow flow applications, (2) use of the FAST2D code to model vorticity and turbulence flow efficiently, (3) an analytical and computational study of the ignition and quenching of laminar flames in a premixed H2, O2, N2 mixture, and (4) incorporation of the latest reactive flow computer packages into the NRL ionosphere code.

57744 (NASA-CR—168848, pp 39-53) **Mechanisms of droplet combustion.** Law, C.K. Mar 1982. NTIS, PC A17/MF A01.

From 2. convention of the international colloquium on drops and bubbles; Monterey, CA, USA (19 Nov 1981).

The fundamental physico-chemical mechanisms governing droplet vaporization and combustion are discussed. Specific topics include governing equations and simplifications, the classical d(2)-Law solution and its subsequent modification, finite-rate kinetics and the flame structure, droplet dynamics, near- and super-critical combustion, combustion of multicomponent fuel blends/emulsions/suspensions, and droplet interaction. Potential research topics are suggested.

57745 (NUREG/CR—2314) **Aging with respect to flammability and other properties in fire-retarded ethylene propylene rubber and chlorosulfonated polyethylene.** Salazar, E.A.; Bouchard, D.A.; Furgal, D.T. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1982. Contract AC04-76DP00789. 65p. (SAND—81-1906). NTIS, PC A04/MF A01.

The flammability characteristics of ethylene propylene and chlorosulfonated polyethylene rubbers containing fire-retardant additives, aged in different thermal and radiation environments have been studied. Flammability parameters for these materials (time to ignition, mass pyrolysis, buring rate and fuel consumption) when exposed to, and aged in thermal, radiation, and thermal/radiation environments are discussed. Two formulations of each type of rubber are compared. The results are a direct contradiction to expected results based on small-scale flammability tests. They show that the fire-retarding agents used in this investigation do not reduce, and in some cases, contribute to, rubber flammability when exposed to a full-scale fire environment. In addition, the results show that for full-scale fire conditions, the energy required for ignition of chlorosulfonated polyethylene is lower than that required for ethylene propylene rubber; a complete reversal of expected results. The effects of aging on the tensile-elongation properties have been determined. Radiation dose-rate effects are also discussed. Results show that the fire-retardant additives have a negligible influence on the tested materials' tensile-elongation properties and on material aging, regardless of the aging environment. The data obtained, however, may be too limited to show significant dose-rate effects. 15 figures, 9 tables.

57746 **Formation and destruction of pollutants in combustion processes: Clearing the air on the role of combustion research.** Sawyer, R.F. (Univ of Calif, Berkeley). *Symposium (International) on Combustion, [Proceedings];* 1-22(1981). (CONF-800809—).

From 18. combustion symposium; Waterloo, Canada (17 Aug 1980).

The application of combustion research and technology has provided an efficient means, often the most cost effective, of reducing pollutant emissions. The fundamental understanding of the chemical and physical processes leading to the formation of pollutants has been critical to the modification of combustion processes for the minimization of pollutants. Both the prevention of formation and the promotion of destruction of pollutants have proven effective. While thermochemistry shows that there is no conflict between a reduction of pollutants and an increase of efficiency of the combustion processes, in application, compromise solutions have led, on occasion, to such trade-offs. Chemical kinetics can produce time scales for pollutant formation and destruction which are difficult to manipulate in practical combustors in a manner compatible with efficient combustion. 61 refs.

42 ENGINEERING

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 56017, 56063, 56064, 56273, 56274, 56277, 56287, 56288, 57374, 57853, 57857, 57912, 57935, 57957, 57959, 57960, 57961, 57963, 57964, 57965, 57966, 58026, 59001, 59062, 59066

57747 (AD-A—109079/4) **Ventilation surge techniques. Volume I. Final report Sep 80-Dec 81.** Wright, M.D.; Berryhill, W.; Wallace, R. (Research Triangle Inst., Durham, NC (USA)). Dec 1981. 150p. (RTI—2084/00-04F-VOL-1). NTIS, PC A07/MF A01.

The objectives of this project were to investigate the effects of partitions, dense occupancy, and expedient openings on the air-flow pattern in fallout shelters. Both experimental and theoretical techniques were used in the study. The experimental program examined airflow patterns for both mechanically driven and thermally driven ventilation. Mechanical ventilation was supplied by an axial fan driven by an electric motor. The thermal ventilation was supplied by simulating the metabolic heat load of the shelter occupants. Because metabolic heat is a combination of sensible and latent heat, a theoretical analysis was made of the relative effect of each type of heat on buoyance. The result showed that latent heat has a much smaller buoyancy effect and, consequently, only the sensible heat input was simulated during the experiments using thermally driven ventilation. Ventilation tests were made using 25 shelter configurations. Airflow patterns and temperature distributions were measured in each configuration using both natural and forced ventilation. An evaluation of the applicability of expedient openings was made using data from the literature and personal contacts. The evaluation addressed a wide variety of construction types and cutting techniques.

57748 (AD-A—109905/0) Information on hydrogen evolution rates for mine batteries and selection of a hydrogen getter; Final report. Holt, F.G. (Naval Mine Engineering Facility, Yorktown, VA (USA)). 1 Feb 1979. 18p. NTIS, PC A02/MF A01.

Mine batteries evolve hydrogen at various rates. In one month at 32 C, volumes ranged from roughly 33 milliliters for Battery Mk 114 Mod 0 to 3 milliliters for Battery Mk 121 Mod 0. At 32 C, F, F50, and F96 cells used in Leclanche batteries produced roughly 0.5 to 2 milliliters of hydrogen per cell in one month. Cells of the 3-AH and R-4R types, used in cadmium-mercuric oxide and zinc-mercuric oxide batteries respectively, produced about 0.4 to 0.6 milliliters of hydrogen. Palladium and palladium oxide getters were selected to eliminate free hydrogen in sealed environments containing mine batteries.

57749 (AD-A—109908/4) Design study of small efficient cryocoolers. Final technical report 14 Apr-11 Sep 80. Sereny, A.; Daniels, A. (Philips Labs., Briarcliff Manor, NY (USA)). Nov 1980. 69p. NTIS, PC A04/MF A01.

A triple-expansion Stirling-cycle refrigerator driven by a linear mechanism was the configuration selected to best meet the requirements of this Phase I design study for a small, low-power, light-weight, efficient, closed-cycle cryocooler. The specifications for the cooling of superconductive magnetometers require the cryogenic refrigerator to operate at 10 degrees K or less with a heat load of 50 mW, have an electrical input power not exceeding 250 W, and have minimum mechanical motion and magnetic signatures. The results of this design study indicate that the 50 mW of refrigeration at 10 degrees K with a maximum power input of 250 W can be readily met with a free-displacer, free-piston system. Three problem areas were identified and analyzed, viz., the lead regenerator matrix, piston seals, and output-temperature fluctuations. An analysis was also made of the magnetic effects of mechanical motion. This report concludes with an outline of the proposed efforts for a Phase II program.

57750 (AD-A—110081/7) Josephson a/d converter development. Annual technical report 1 May 80-30 Apr 81. Hamilton, C.A.; Harris, R.E.; Kautz, R.L.; Lloyd, F.L.; Peterson, R.L. (National Bureau of Standards, Boulder, CO (USA)). Oct 1981. 72p. NTIS, PC A04/MF A01.

This report describes the fourth year of an effort to demonstrate an ultra-high-speed analog-to-digital converter using superconducting electronics. A converter was fabricated and tested at a sample rate of 4 x 10 to the 9th power samples/second.

57751 (AD-A—110128/6) Niobium nitride Josephson devices with semiconductor barriers. Final report 27 May 80-25 Sep 81. Kroger, H.; Jillie, D.W.; Smith, L.N. (Sperry Research Center, Sudbury, MA (USA)). Sep 1981. 49p. (SRC-CR—81-65). NTIS, PC A03/MF A01.

Semiconductor barriers are investigated as a means of producing NbN-barrier-NbN and NbN-barrier-Nb Josephson devices. Chemical vapor deposition of silicon and germanium polycrystalline barriers onto NbN substrates and sputter deposition of amorphous silicon onto NbN substrates were used to produce the barrier layers. NbN-aSi-Nb tunnel junctions which had a Vm (product of critical current and subgap resistance) as high as 15 mV were fabricated. Phosphorus doped Ge barriers about 60 A thick produced tunnel junctions with Vm = 2-3 mV. Super Schottky diodes were produced with boron doped germanium barriers about 130 A thick. Boron doped germanium barriers about 60-70 A thick were observed to have Josephson coupling with good uniformity as judged by ideal threshold curves, but had non-ideal tunneling characteristics. NbN-Ge-NbN devices were produced by first depositing the trilayer structure over the entire wafer and then isolating the desired junctions by thermally oxidizing the upper NbN layer between devices, with the device area being protected from oxidization by a patterned SiO2 layer. Some correlation between good tunneling characteristics and the crystal structure and high optical reflectivity of the lower NbN electrode was observed.

57752 (AD-A—110919/8) Testing of shelter design and industrial hardening concepts at the Mill Race event. Final report. Tansley, R.S.; Zaccor, J.V. (Scientific Service, Inc., Redwood City, CA (USA)). Jan 1982. 219p. (SSI—8115-4). NTIS, PC A10/MF A01.

The report presents the results of the experiments conducted for the Federal Emergency Management Agency at the MILL RACE high explosive test. The MILL RACE event provides a simulated nuclear weapon airblast and ground motion environment to demonstrate, using full-scale structures and test objects, the validity and practicality of a number of blast upgrading and industrial hardening concepts that will support current Civil Defense planning. The design, construction, and objectives of each of the experiments are described and illustrated, and the test data and conclusions are presented. The experiments included host area and key worker shelters, expedient shelters, and industrial hardening experiments at the 2, 20, and 40 psi peak overpressure levels.

57753 (AD-A—111011/3) Virial theorem and scaling laws for superconducting magnet systems. Topical report, February-May 1981. Moon, F.C. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). 31 May 1981. 33p. (TR—5). NTIS, PC A03/MF A01.

The structural masses of over thirty superconducting magnet designs are shown to exceed that required by the virial theorem by factors of from two to ten or more. Designs for MHD and toroidal field (TF) fusion magnets from many different magnet groups around the world obey a stored energy-mass scaling law of the form E = CM4/3. This scaling law appears to be valid over three to four orders of magnitude of stored magnetic energy. The 4/3 power law differs from the linear scaling derived from the virial theorem and appears to result from the thermal stability requirements of the super-conductor. However, the masses of large scale TF magnets are approaching the regime where the structural mass required by the virial theorem will place greater constraints on the design than the thermal stability.

57754 (AD-A—111072/5) Applications of Josephson junction SQUIDS and arrays. Quarterly report no. 1, 8 September-25 December 1981. Silver, A.H. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA). Applied Technology Div.). 15 Jan 1982. 18p. NTIS, PC A02/MF A01.

This is a new contract for a projected multi-year investigation of Superconducting Quantum Interference Device (SQUID) arrays and their application to microwave technology. The focus of this contract is the investigation and demonstration of a SQUID voltage-controlled oscillator (VCO). The array is then projected to increase the available power and operating impedance. The approach adopted will utilize monolithic superconducting integrated circuits which will be designed, fabricated, and tested at TRW. The project has three tasks: (1) Analysis of dc SQUID Arrays; (2) Design of dc SQUID Generator; and (3) SQUID VCO Fabrication and Measurement which are being carried out.

57755 (BDX—613-2775) Transformer fabrication processes. Final report. Jordan, H.F. (Bendix Corp., Kansas City, MO (USA)). Jun 1982. Contract AC04-76-DP00613. 36p. NTIS, PC A03/MF A01. Order Number DE82015786.

Mathematical methods of analyzing process variations and points during fabrication at which tests should be performed have been established for four transformer types currently in production. The methods given can minimize losses caused by process variations and can reduce costs by eliminating unnecessary tests.

57756 (BDX—613-2806) **Laser stripping of coal cables.** Hollar, D.L. (Bendix Corp., Kansas City, MO (USA)). Aug 1982. Contract AC04-76DP00613. 19p. NTIS, PC A02/MF A01. Order Number DE82020367.

Portions of document are illegible.

Kapton-insulated wire and miniature coax cables are usually stripped with guillotine-shaped blades. This method has the inherent risk of nicking wire strands. The CO_2 laser beam can cut through Kapton without damaging wire strands underneath. This project developed a Kapton insulation stripping apparatus to be used in conjunction with any 50 W (minimum) CO_2 laser source. Feasibility of laser stripping Kapton-insulated wire and coax without damage was proven.

57757 (DOE/BC/10364—24) **Improvement of drilling capabilities of PDC cutters in hard formation. Final report.** Park, A. (Diamond Oil Well Drilling Co., Midland, TX (USA)). Aug 1982. Contract AC19-80BC10364. 32p. NTIS, PC A03/MF A01. Order Number DE82020251.

Fifteen bits were designed, fabricated, and field tested in an effort to improve Polycrystalline Diamond Compact (PDC) bits for hard formations. Some conclusions are presented regarding design of hard formation bits. The performance is described for the 15 bits tested. Some bit design layouts and photographs are shown. The work is considered to be successful and some excellent results were obtained. Bit No. 9 drilled 5949 feet averaging 33 ft/h and Bit No. 16 drilled 1100 feet of hard rock averaging 8.7 ft/h. Problems that were encountered early were resolved and coring penetration rates ranging from two to six times faster than conventional diamond core bits were achieved. The full-face PDC drill bits showed improved penetration over roller cone bits when drilling medium and hard formations but breakage of the nose cutters occurred when extremely hard formations were encountered. 18 figures.

57758 (DOE/EV/10448—T1) **LNG release-prevention demonstration program: stress-analysis report.** (Cv International, Inc., Torrance, CA (USA)). 26 Feb 1982. Contract AC01-81EV10448. 30p. NTIS, PC A03/MF A01. Order Number DE82008178.

The results of an analysis performed to determine the thermal transient stress in a coaxial pipe joint during cooldown are presented. Liquid nitrogen was used as a cooling agent in a test setup. The temperature-time history for the inner and outer pipes was determined at various coolant flow rates. These temperatures are analyzed to determine the condition at which maximum stress occurs. The maximum stress occurs in the inner pipe adjacent to the upstream corner of the spoke. The cooldown method which produces lowest stress is to use a flow vapor in the annulus. This provides a practical cooldown rate while maintaining a low level of stress.

57759 (DOE/MC/16050—1225) **System planning report for use of failure and operational reporting system.** (TRW Energy Engineering Div., McLean, VA (USA)). 25 Jun 1982. Contract AC21-81MC16050. 35p. NTIS, PC A03/MF A01. Order Number DE82018785.

The Failure and Operational Reporting System (FORS) was developed to meet the need for collecting, organizing and processing critical plant operating and failure experience data. The design of the system is different from that used on other reporting systems; it excludes many conventional reporting functions, providing only for the selective reporting of significant data. An important characteristic of FORS is its flexibility to provide unique plant-specific data for a variety of plants. While the data are intended for use in the detection, analysis, and resolution of particular problems occuring at specific plants, its major purposes are to facilitate inter-plant exchange of technical information on plant design, operation, failure and maintenance and to form a historical data base for use in product improvement and new plant design. The FORS design thus has a strong potential for achieving immediate and practical benefits from a minimum effort at low cost, while at the same time forming the basis for longer range improvements in plant and equipment designs and operating practices.

57760 (INIS-mf—7093, pp vp) **Heat exchanger tubes: production, properties, applications.** Tucek, J. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A11/MF A01.

From Conference on steels and alloys for nuclear power; Pizen, Czechoslovakia (20 Sep 1979).

Materials and production technologies used for brass condenser tubes produced since 1945 are discussed. The effect of production technology on the quality of tubes, the type of defects and corrosion resistance is considered. Operating corrosion tests using sea water showed corrosion attacks at inlet and outlet ends while 72,000-hour operation in condensers showed corrosion going deeper than 0.8 mm in 40% of the tubes.

57761 (SAND—81-2546) **Program to predict performance of a gas gun.** Hardy, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1981. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01. Order Number DE82007644.

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A program which runs in SPS Basic on the PDP-11 computer has been written to maintain a performance data file for the 100 mm single-stage compressed light gas gun. This program can be used to update the master file which is located on a floppy disk by adding recent shot data. It will also perform a third-order least-square fit to the data to determine the gas load for a specified projectile weight and velocity.

57762 (UCID—19476) **Development of lightweight filament-wound composite vessels.** Kulkarni, S.V.; Chambers, D.I.; Caley, L.E. (Lawrence Livermore National Lab., CA (USA)). May 1982. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE82020427.

Portions of document are illegible.

Work is reported in the area of design, fabrication, testing and evaluation of various high performance composite pressure vessels with elastomeric and metallic liners. The thrust of this effort was to develop a high performance, fatigue resistant, potentially low-cost ultra-thin titanium-lined high-strength graphite/epoxy spherical pressure vessel for space shuttle applications; and to fabricate Kevlar-49/epoxy elastomeric lined cylindrical pressure vessels with both rigid and flexibilized epoxy resins. With regard to the ultra-thin Ti liner development, it became apparent that the effort required to develop a fabrication process which will meet both the performance and cost requirements was beyond the scope of this program. Consequently, this effort was stopped. However, the potential for developing ultra-thin Ti liners at a reasonably low cost still exists and should be pursued. From the limited number of burst tests that were conducted for the Kevlar-49/epoxy elastomer-lined cylindrical vessels it is evident that both the damage growth process and the failure modes are different for rigid and flexibilized epoxy resin systems. The effect on the performance cannot be, however, conclusively determined at this time. Further testing of these vessels at NASA LeRC may throw some more light on this issue.

57763 (UCRL—86689) **Development of a facility for fatigue and fracture testing of stainless-steel weldments and base metal at liquid-helium temperature.** Juhas, M.C.; Duncan, D.; Streit, R.D. (Lawrence Livermore National Lab., CA (USA)). 2 Sep 1981. Contract W-7405-ENG-48. 23p. (CONF-810835—46). NTIS, PC A02/MF A01. Order Number DE82020172.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

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A mechanical test facility was built for evaluation of fatigue and fracture properties of stainless steel weldments at liquid helium temperatures. Specific design considerations included minimal usage of liquid helium, facility cost, and ease of operation. Unique design features were thermal isolation of cryogenic load train from hydraulic actuator and load frame, utilization of high strength and toughness behavior of 304LN and 21 Cr-6Ni-9 Mn stainless steels at 4K for load bearing members, and minimization of thermal mass of the test fixture. The facility is utilized for fatigue crack growth studies as well as fracture analysis including J-integral evaluation.

57764 **(Y/DX—423) Diamond turning of steel in a carbon-saturated atmosphere.** Casstevens, J.M. (Oak Ridge Y-12 Plant, TN (USA)). 2 Jun 1982. Contract W-7405-ENG-26. 33p. (CONF-820641—2). NTIS, PC A03/MF A01. Order Number DE82019811.

From Workshop on Precision Machining Society of manufacturing engineers; St Paul, MN, USA (6 Jun 1982).

The wear of diamond tools when machining steels under carbon dioxide and methane gases is investigated. It is shown that diamond tool wear on steels appears to be significantly reduced due to the effects of the methane gas atmosphere. Applicable literature is reviewed and an explanation for the effectiveness of a gas rich in carbon is given. A description of the experimental apparatus and procedure is given along with results of experiments with two types of steel.

57765 **Resistive coating for current conductors in cryogenic applications.** Hirayama, C.; Wagner, G.R. (to Department Of Energy). US Patent 4,330,347. 18 May 1982. Filed date 28 Jan 1980. vp.

PAT-APPL-115866.

This invention relates to a resistive or semiconducting coating for use on current conductors in cryogenic applications. This includes copper-clad superconductor wire, copper wire used for stabilizing superconductor magnets, and for hyperconductors. The coating is a film of cuprous sulfide (Cu2S) that has been found not to degrade the properties of the conductors. It is very adherent to the respective conductors and satisfies the mechanical, thermal and electrical requirements of coatings for the conductors.

57766 **Oscillations in the temperature dependence of Josephson supercurrents in SNS junctions.** Nagata, S.; Yang, H.C.; Finnemore, D.K. (Ames Laboratory-U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *B: Condensed Matter;* **25**: No. 9, 6012-6014(1 May 1982).

Oscillation have been observed in the temperature dependence of the Josephson critical supercurrent of lead-zinc-lead (SNS) junctions. These oscillations occur only in the presence of a magnetic field and the period decreases as the temperature approaches T/sub c/. Model calculations indicate that this phenomenon is related to changes in the Fraunhofer diffraction pattern with temperature.

57767 **Cryogenic structural support.** Gonczy, J.D.; Mataya, K.F.; Niemann, R.C. (to Department Of Energy). US Patent 4,325,530. 20 Apr 1982. Filed date 2 Mar 1978. vp.

PAT-APPL-882726.

A tensile support member is provided for use in a cryogenic environment. The member is in the form of a link formed of an epoxy glass laminate with at least one ply of the laminate having its fibers aligned circumferentially about the link.

57768 **Electrical characteristics of a dc superconducting cable.** Chowdhuri, P. (Los Alamos National Lab., NM (USA)). *Cryogenics;* **22**: No. 4, 171-180(Apr 1982).

The electrical system constraints which are particularly applicable to a dc superconducting cable are discussed and the design of such a cable to be compatible with the electrical system, considered. Work on low temperature dielectrics performed at Los Alamos is summarized showing the variation of breakdown voltage of dielectric materials, in sheet form and cable configuration, with temperature and pressure under dc and impulse voltage. The surface flashover characteristics with large creepage distance as well as electrical conductivity of dielectric materials at cryogenic temperatures are discussed.

57769 **Properties of air leaving a hydraulic air compressor (HAC).** Lip-Ting, C.; Rice, W. (Ariz State Univ, Tempe). *American Society of Mechanical Engineers,* [*Paper*]; No. 82-Pet-15, vp(Mar 1982).

An analysis is made of the diffusion rate controlled absorption of air into the water in the two-phase flow processes occurring in a hydraulic air compressor (HAC). The analysis enables calculation of the fraction of air absorbed, when implemented as an addition to an earlier computerized model for the flow in an HAC which did not account for air absorption. 9 refs.

57770 **Vitrification of high-level wastes: A review of the computer thermal analysis for storage canisters.** Wescott, R.I.; Slate, S.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Nuclear Engineering and Design;* **67**: No. 3, 447-458(Feb 1982).

CANIST, a two-dimensional (r and THETA) computer program that solves the unsteady-state, heat-conduction equation, was used to model the thermal behavior of canisters filled with waste glass. CANIST has been found to be a valuable analytical tool for predicting the temperature profile of a waste storage canister as a function of several variables, including the diameter of the canister, the placement of internal fins, the heat generation rate of the waste glass, and the thermophysical properties of the canister and the waste glass. Thus, temperature-dependent processes that may affect the integrity of the glass/canister unit, for example cracking, can be investigated using an analytical approach.

57771 **Conference on electromagnetic guns and launchers, 1980.** Anon. (US Army Armaments Res and Dev Command (ARRADCOM)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-18**: No. 1, vp(Jan 1982). (CONF-801138—).

From Electromagnetic guns and launchers conference; San Diego, CA, USA (4 Nov 1980).

Proceedings includes 31 papers dealing with the physical principles and engineering technology associated with the development of electromagnetic propulsion, with emphasis on its use for guns, launchers as well as other military equipment. Topics covered include: rail guns, projectiles, mass accelerators, electric motors and generators, nuclear reactors, superconducting devices, plasma acceleration and confinement, traveling magnetic waves, aerospace propulsion, space shuttles, homopolar generators, fusion reactors, tokamaks, impact fusion, and electric power generation. 14 papers are abstracted and indexed separately.

57772 **Pulsed power for electromagnetic launching.** Cowan, M. (Sandia Natl Lab, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-18**: No. 1, 145-150(Jan 1982).

There are system advantages to producing power for electromagnetic propulsion by real time generation rather than by a sequence of generation-storage-switching. The best type of generator for this purpose is the flux compression generator. Different types of flux compression generator are reviewed and their applications to electric launching are discussed. New experimental facilities for producing more powerful generators are described and cost comparisons are made. 10 refs.

57773 **Technical and economic assessment of computer vision for industrial inspection and robotic assembly.** Kruger, R.P. (Los Alamos National Lab., NM); Thompson, W.B. *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers);* **69**: No. 12, 1524-1538(Dec 1981). Contract W-7405-ENG-36.

The use of computer vision to detect, measure, and perhaps guide the assembly of man-made components is potentially a very significant research and development area. The efficacy of these techniques for any given application depends on both technical and economic considerations. This paper will explore both these considerations using appropriate generic examples. It is our goal to first present a concise discussion of the present state of many technical and economic factors and then extrapolate these factors into the future for the purpose of guiding further investigations.

57774 **Two-dimensional image transmission through optical fibers by wavelength multiplexing.** Reedy, R.P. (Lawrence Livermore National Lab., CA). *Optical Engineering;* **20**: No. 6, 927-931(Nov 1981). Contract W-7405-ENG-48.

The number of data points transmitted by an optical waveguide can be greatly increased by assigning one narrow wavelength region to each data point. The technique, called wavelength or spectral multiplexing, allows hundreds of data points to be transmitted simultaneously over a few fibers. This paper outlines the concept of a two-dimensional-grating multiplexer (and demultiplexer) and includes factors governing the design, test techniques, and experimental results derived after constructing such a system. This experimental system simultaneously transmits and reconstructs 5 x 10^3 high quality data points from a two-dimensional object through 50 fibers in a linear array. Information concerning resolution, system efficiency, distortion, wavelength range, and the selection of components is included.

57775 Flange loads measurements in a cylindrical roller bearing. Dow, T.A.; Kannel, J.W. (Battelle, Columbus Lab, Ohio). *American Society of Mechanical Engineers, [Paper];* No. 81-Lub-18, 1-5(1981).

A method of measuring the forces between a roller and the guide flange in a turbine main shaft bearing has been developed. Experimental measurements of these forces were made for a nonpreloaded bearing with nominally balanced rollers and also intentionally unbalanced rollers. The bearing was radially loaded and measurements of the flange forces were made with the rollers, both in and out of the loaded region. Two different lubricants were studied, and significantly different flange forces were measured as a result of the change in viscosity. 12 refs.

57776 Whispering-mode waveguide. Kurnit, N.A. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **288**: 142-153(1981).

Properties of a relatively new type of waveguide structure of potential use for confining infrared radiation to a small mode volume over long path lengths are reviewed. A single guiding surface with curvature radius rho and bend radius R allows propagation of a near-grazing incidence whispering mode of transverse width ~ ($\lambda \surd$ rho R/π)/sup 1/2/ and radial width ~ 1/2 (λ ^{2}R)/ sup 1/3/. For sufficiently large rho, the loss per revolution for TE-mode propgation is ~ π A/sub N/, where A/sub N/ is the normal-incidence reflection loss. Results on a number of prototype structures in general agreement with these considerations are described.

57777 Craft estimation as a spin-off from cost estimation. Van Wie, N.H. (Union Carbide Corporation, Oak Ridge, TN). *Transactions of the American Association of Cost Engineers;* 58-64(1978). (CONF-780710—).

From 22. American Association of Cost Engineers meeting; San Francisco, CA, USA (9 Jul 1978).

A brief review of the basic system of automated estimating at Union Carbide Corp., Nuclear Division, is provided. Emphasis is placed during this review on the labor component of estimates to show the derivation of relevant data for manpower analysis. Our techniques of computing the results needed for manpower analysis are then described. While the advantages of doing manpower analysis are more or less self-evident, this automated system adds the additional feature of enabling easy study of what-if questions, such as the impact of labor rates that vary between cities or areas.

4203 Lasers

REFER ALSO TO CITATION(S) 57471, 57776, 57913, 58984

57778 (AD-A—109129/7) Development of a novel laser material for miniaturized laser systems. Quarterly technical report No. 4, 1 Jul-30 Sep 81. Zwicker, W.K.; Colak, S.; Khurgin, J. (Philips Labs., Briarcliff Manor, NY (USA)). Nov 1981. 28p. NTIS, PC A03/MF A01.

Our work during this quarter dealt with the growth and evaluation of NPP crystals for a 1.06 micrometer miniature laser and Er(3+) stoichiometric crystals for an eyesafe miniature laser emitting at 1.54 micrometer. Crystals of NPP up to 2x2x20 mm for fabrication of miniature laser rods were grown by a previously described high-temperature, solution-growth technique. Flash-lamp-pumped lasing experiments were conducted using various sizes of NPP crystals, in both the free-oscillation and Q-switched modes at different pulse repetition rates. Output pulse energies and properties of the laser output beam were measured. The efficiencies for the free-oscillation mode were close to the maximum published values; for the Q-switched mode, the efficiencies were low compared to published values. Crystals of ErP_5O_{14} were grown by the same technique used for NPP; crystals of $ErLiP_4O_{12}$ and $ErAl_3(BO_3)_4$ were grown by related fluxed-melt techniques. These crystals were several millimeters in size. Both Yb and Gd were added in various ratios as sensitizing and/or diluent ions. The absorption and emission properties of the Er3+ luminescence in some samples of ErP_5O_{14}, $LiErP_4O_{12}$, and $ErAl_3(BO_3)_4$ have been studied both in the visible and infrared regions of the spectrum. Preliminary evaluations of these materials for laser applications have been made.

57779 (AD-A—110227/6) The three-dimensional non-linear theory of the free electron laser in the amplifying configuration. Memorandum report. Sprangle, P.; Tang, C. (Naval Research Lab., Washington, DC (USA)). 28 Dec 1981. 45p. (NRL-MR—4663). NTIS, PC A03/MF A01.

This paper presents a self-consistent non-linear treatment of the finite transverse dimensional effects associated with (1) the wiggler field, (2) the electron beam and (3) the radiation beam of the free electron laser (FEL) in a steady state amplifying configuration. Our formulation incorporates various efficiency enhancement schemes. A linearly polarized magnetic wiggler is used for our formulation. The inherent gradient of the magnetic wigglers in the transverse direction introduces betatron oscillations, which cause an increase in the effective axial beam temperature. The radiation beam in the presence of the electron beam and the magnetic wiggler experience diffraction as well as refraction effects. We find that the 3-D effects can lead to substantial differences in the effects compared to the 1-D theory. Finally a 3-D numerical illustration of a 10.6 micron FEL is given.

57780 (AD-A—110306/8) Free electron laser theoretical study. Final report 1 Jul 80-30 Sep 81. Caponi, M.Z.; Shih, C.; Dawson, J.; Lin, T.; Whang, K. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). 30 Nov 1981. 110p. (FEL—27R). NTIS, PC A06/MF A01.

This is the final report of the Free Electron Laser Theoretical Study carried out by TRW for the AFOSR during the period July 80 to September 81. Four distinct but interrelated problems that play an important role in the characteristics of a Free Electron Laser oscillator were investigated: (1) Transverse Effects: The effect of wiggler field inhomogeneity as well as the influence of different transverse profiles of the signal field and the electron beam on the FEL characteristics were studied in detail. A dramatic decrease in gain and efficiency is found with increasing value of the ratio of electron beam radius to photon beam radius. (2) Small Signal (SS) Gain: A1-D investigation of the small signal gain for a Tapered Wiggler Free Electron Laser was performed analytically for cold electron beams and numerically for cold and warm electron beams. It was found that the small signal gain spectrum shifts and decreases in amplitude as a function of increasing wiggler taper. (3) Multicomponent Wiggler Free Electron Laser (MCWFEL): The results from (1) and (2) motivated the development of a new FEL configuration that could have high small signal gain and sufficiently high efficiency at high powers with nearly the same output frequency. The new FEL is a combination of several wiggler components. (4) Finite Pulse Length Simulations and Kinetic Effects of Trapped Particle Instabilities in Free Electron Lasers: A 1-D finite pulse code was developed and the effects of pulse slippage detrapping of electrons at the beam edge and parasitic instabilities investigated for a tapered wiggler Free Electron Laser.

57781 (AD-A—110837/2) Bibliography of Soviet laser developments, November-December 1980. (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 30 Nov 1981. 126p. (DIA-DST—2700Z-001-82). NTIS, PC A07/MF A01.

57782 (AD-A—110886/9) Characterization of the optical properties of laser and phosphor crystals. Final report 15 January 1979-14 January 1982. Powell, R.C. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). 14 Jan 1982. 115p. NTIS, PC A06/MF A01.

This research involves the utilization of laser optics such as time-resolved site-selection spectroscopy, photoacoustic spectroscopy, and four-wave mixing spectroscopy to characterize dynamical optical properties such as energy transfer and radiationless relaxation processes in phosphor and laser materials. The materials investigated included stoichiometric laser materials such as neodymium pentaphosphate and neodymium aluminum borate, and lightly doped laser materials such as neodymium doped yttrium vanadate, garnets and glasses. In addition, several theoretical approaches and computer modeling techniques were developed for analyzing the properties of energy transfer among ions in solids. Some of the important results obtained in this work include the direct measurement of the exciton diffusion coefficient in Nd sub x La sub 1-x P5O14 crystals, the measurement of the quantum efficiency of Nd(3+) in various hosts, and the development of Monte Carlo modeling techniques for describing energy migration on a random lattice.

57783 **(AD-A—110924/8) Model of the para-terphenyl dye laser.** Fournier, G. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). Nov 1981. 52p. (DREV-R—4224/81). NTIS, PC A04/MF A01.

A theoretical model for a Para-Terphenyl dye laser pumped by an excimer laser has been developed. A new set of reaction-rate coefficients for Para-Terphenyl has been established. The problem of spontaneous emission in a dye has been solved analytically. The numerical solutions of the laser equations agree closely with the experimental results reported in the literature. Use of our model resulted in the achievement of higher efficiencies and narrower linewidths than those previously reported.

57784 **(AD-A—111042/8) Hydrogen pumped iodine laser study. Final report May 1976-September 1979.** Blauer, J.A.; Raymonda, J.W.; Janiak, D.R.; Hager, G.D.; Shortridge, R. (Bell Aerospace Textron, Buffalo, NY (USA)). Jul 1980. 73p. NTIS, PC A04/MF A01.

Experimental data relative to attempts to induce lasing at 1.3154 microns in a chemical atomic iodine medium are presented. The critical issue was the establishment of high number densities of hydrogen atoms. First, atomic hydrogen was prepared by shock-heating mixtures of H2 in Ar. The plenum gases were accelerated through a nozzle bank and molecular HI was injected into the flow. Medium diagnostics were conducted in a windowed section downstream of the nozzle exit plane, on both 3 in. and 12 in. nozzle arrays. All attempts employing the shock tube to induce lasing in this chemical system were unsuccessful and measurements of small signal gain yielded ambiguous results. The major problem was probably loss of hydrogen atoms by wall recombustion. Following this, a CW approach for the in-situ chemical formation of atomic hydrogen involving reaction between sodium vapor and HI was tested in a flow reactor. Double-resonance gain measurements indicated loss rather than gain. Shock-tube experiments using conditions that previously yielded gain were repeated using the double-resonance gain diagnostic, and only loss was found. On the basis of these experimental results, it is recommended that efforts to obtain lasing from a hydrogen pumped iodine medium be discontinued.

57785 **(AD-A—111137/6) Observation and analysis of LiCa and LiMg excimers. Doctoral thesis.** Neumann, D.K. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Aug 1981. 144p. (AFIT/DS/PH—80-3). NTIS, PC A07/MF A01.

Emission from LiCa and LiMg excimers was obtained for the first time upon pumping mixtures of Li and Ca vapors and Li and Mg vapors with an Ar+ laser. The emission spectra were analyzed spectroscopically and found to be in good agreement with a synthetic spectrum derived from ab initio calculations of the LiMg and LiCa potential energy curves. A kinetic model was developed to explain the LiMg formation process. The kinetics of production of LiMg were analyzed by time delay measurements and efficiency measurements of the fluorescence intensity.

57786 **(AD-A—111140/0) Characterization of an hf-pumped CO_2 laser. Master's thesis.** Perram, G.P. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Oct 1981. 163p. (AFIT/GEP/PH—81D-7). NTIS, PC A08/MF A01.

The purpose of this study was to characterize the performance of an optically pumped molecular laser and determine the effect of pump frequency on output power. Specifically, the P2(6) transition in a chemical HF laser is used to pump $^{13}C^{18}0_2$ molecules from the ground state to the 101 vibrational energy level. A population inversion is established between the 101 and 100 energy levels and lasing action is achieved at 4.3 microns. The results of a theoretical analysis and an experimental study are used to maximize the system's performance, clarify the principles of operation, and to resolve discrepancies between theory and prior experimental observations.

57787 **(AD-A—111160/8) Effect of fluctuating space charge fields on sideband instabilities in free electron lasers. Memorandum report.** Freund, H.P.; Sprangle, P.; Tang, C.M. (Naval Research Lab., Washington, DC (USA)). 22 Oct 1981. 34p. (NRL-MR—4656). NTIS, PC A03/MF A01.

We consider the sideband instabilities that can occur in free electron lasers which operate in the regime where the bulk of the energetic electron beam is trapped in the ponderomotive potential generated by the beating of the electromagnetic pulse with the static wiggler field. The general dynamical equations which govern the evolution of the system in the presence of sideband modes are derived for modes propagating along the axis of symmetry. All space-charge effects are included in a self-consistent manner, and the gains for both the primary signal and the upper and lower sidebands are computed. We find the lower sideband to be excited, and discuss the consequences for operation of both free electron laser amplifiers and oscillators. The effect of the space-charge waves on the gain depends upon the number of bounces undergone by the trapped electrons in the length of the system, and can act either to enhance or reduce the gain of the sideband.

57788 **(AD-A—111341/4) Nanosecond near millimeter waves. Final report 21 Jul 80-1 Oct 81.** DeTemple, T.A. (Illinois Univ., Urbana (USA). Dept. of Electrical Engineering). Oct 1981. 98p. (UILU-ENG—81-2554). NTIS, PC A05/MF A01.

The primary goals of this study were directed at theoretical and experimental aspects of the use of mode-locked carbon dioxide lasers as a means of generating temporally short near millimeter (NMM) wavelengths in the range 100 micrometers to 3 millimeters by optical pumping of light molecules. Both aspects of the work were quite successful in that mode-locked trains of NMM waves were generated, sometimes with a high conversion efficiency, and the overall space-time evolution and conversion predicted by the modeling was in accord with the experimental observation. The main implications of this work are that pulses shorter than the inverse bandwidth can be produced but that the overall pulse evolution occurs on a longer spatial scale than for bandwidth limited pulses. The role of cooperative phenomena such as superradiance and multiphoton effects such as stimulated Raman emission were seen to be important in explaining the evolution of the pulses.

57789 **(AD-A—111455/2) Collective effects on the operation of free electron lasers with an axial guide field. Memorandum report.** Freund, H.P.; Sprangle, P.; Dillenburg, D.; da Jornada, E.H.; Schneider, R.S. (Naval Research Lab., Washington, DC (USA)). 19 Feb 1982. 41p. (NRL-MR—4763). NTIS, PC A03/MF A01.

The collective interaction in a free electron laser with combined helical wiggler and uniform axial guide fields is presented in the linearized regime. The analysis involves a perturbation of the Vlasov-Maxwell equations about the constant-velocity helical trajectories, and the general driving currents are derived for this configuration. The complete dispersion equation is then obtained for a monoenergetic beam. Analytic solutions are obtained in the strong pump and a space-charge dominated regimes, and an extensive numerical analysis is presented for a wide range of operating parameters. The results indicate that substantial enhancements in the gain are possible when the relativistic axial gyrofrequency is comparable to the Free Electron Laser Doppler Upshift. In addition, there is a range of parameters for which the ponderomotive potential acts to destabilize the electron beam. In this regime, we find both unstable electrostatic beam modes and largely electromagnetic modes with broad bandwidths.

57790 (AD-A—111682/1) Transverse beam dynamics in the modified betatron. Memorandum report. Chernin, D.P.; Sprangle, P. (Naval Research Lab., Washington, DC (USA)). 1 Mar 1982. 46p. (NRL-MR—4687). NTIS, PC A03/MF A01.

The linearized equations governing the motion of the center of a beam about its equilibrium position in a modified betatron, as well as equations governing the motion of an individual particle about the beam center, are presented and solved. Self field effects, including toroidal hoop stresses and wall image forces, are included in the analysis. All fields, both self and applied, are assumed to be azimuthally symmetric but are allowed to have arbitrary time dependences. The solutions to the equations of motion are analyzed for stability and conditions for stability are obtained. Further study of the solutions illustrates two phenomena of experimental interest: (1) the unavoidable traversal of a finite 'instability gap' in parameter space during acceleration; and (2) the adiabatic increase in the amplitude of the betatron oscillations during removal of the toroidal magnetic field, prior to beam ejection. By careful design, the effects of these phenomena can be reduced to insignificant levels in an actual accelerator.

57791 (ILE—8015P) Saturation mechanism and improvement of conversion efficiency of free electron laser. Taguchi, T.; Mima, K.; Mochizuki, T. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 15 Oct 1980. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702507.

Saturation mechanisms of free electron laser are investigated in the Compton regime. It is found that the saturation occurs due to quasi-linear energy spreading of electron beam in the case of many mode excitation. The energy conversion efficiency remains low even if many modes are taken into account. For improvement of the conversion efficiency, effects of reacceleration by a traveling wave are investigated and turn out to increase the efficiency up to more than 50%.

57792 (KFKI—1981-62) Fresnel-reflexion-halo lasers. Horvath, Z.G.; Varro, S. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82902778.

Portions of document are illegible.

Planar laser action of two-dimensional disc-shaped active material is reviewed for the light emerging because of Fresnel reflections in the partly closed cylindrical Fabry-Perot resonator constituting the natural surrounding of the material. The calculations presented show that a proper choice of pumping permits the value and the spatial distribituion of the gain to be conveniently set. This enables one to obtain a single mode planar laser.

57793 (KFTI—81-41) Tuned sources of submillimetre radiation. Berezhnyj, V.L. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 38p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702006.

The main present directions of development of sources of frequency coherent tuned radiation of electromagnetic waves in the submillimeter range: nonlinear mixing of different frequencies; semiconductor lasers; molecular lasers with optical pumping; relativistic electron beams in a magnetic field as submillimeter radiation sources; submillimeter radiation sources on the basis of SHF classical electrovacuum devices - are considered. The designs of generator systems and their specifications are presented. The main parameters of electromagnetic radiation of different sources, such as: power, stability, frequency, tuning range - are presented. The methods of improving sources and electromagnetic radiation parameters are proposed. The examples of possible applications of submillimeter radiation in different spheres of science and technology are given.

57794 High pressure measurements on visible spectrum Al/sub x/Ga/sub 1-x/As heterostructure lasers: 7100—6750-A 300-K operation. Kirchoefer, S.W.; Meehan, K.; Holonyak, N. Jr.; Gulino, D.A.; Drickamer, H.G.; Burnham, R.D.; Scifres, D.R. (Electrical Engineering Research Laboratory and Materials Research Laboratory, University of Illinois at Urbana—Champaign, Urbana, Illinois 61801). *Applied Physics Letters;* **41**: No. 5, 406-407(1 Sep 1982). Contract AC02-76ER01198.

Pressure applied to high performance cw 300-K bulk-limit (L/sub z/~ 600 A) single quantum well heterostructure Al/sub x/Ga/sub 1-x/As (x~0.28, λ~7100 A) laser diodes is used to simulate composition change and determine the threshold increase at shorter wavelength. Unless small quantum well sizes are employed in more sophisticated designs it is unlikely that λ (for cw 300-K operation) can be made much less than 6900 A.

57795 Madey's gain-spread theorem for the free-electron laser and the theory of stochastic processes. Krinsky, S.; Wang, J.M.; Luchini, P. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **53**: No. 8, 5453-5458(Aug 1982).

We elucidate the correspondence between Madey's gain-spread theorem for the free-electron laser, and a similar theorem obtained for the Brownian motion of a stochastically driven oscillator. By using suitable changes of variables, these two different theorems can be shown to be special cases of a more general result valid for a mechanical system described by a Hamiltonian of the form $H = H_0(p,t)+\lambda H_1(q,p,t)$. For such a system, when terms up to second order in λ are kept, under certain specified conditions it follows that $<\Delta p> = (1/2)$ (partial/partialp/sub i/) $<(\Delta p)^2>$, where Δp is the change in p in time Δt, and the average is over the initial value of the coordinate q/sub i/, for fixed time and initial momentum p/sub i/. In the case of the free-electron laser, the canonical momentum p must be chosen as the total energy E of the electron, while for the driven oscillator, the necessary choice is the action variable J corresponding to the unperturbed periodic motion.

57796 Laser rod holder during grinding and polishing. Hed, P.P. (University of California, Lawrence Livermore National Laboratory, P.O. Box 808 Livermore, California 94550). *Applied Optics;* **21**: No. 9, 1539-1540(1 May 1982).

A technique for clamping a laser rod during optical surfacing and polishing is described which is superior to the commonly used method of cementing the rod into a hole in a metal block. (AIP)

57797 Possible Fourier transform laser spectrometer for tunable lidar and laboratory spectroscopy. Hirschfeld, T. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Applied Spectroscopy;* **36**: No. 3, 329-330(May 1982).

A new procedure, intermediate between heterodyne and homodyne detection, allows one to combine the spectral range of the latter with the sensitivity of the former. In this procedure, the same laser is used for signal generation and as the local oscillator, while continuously frequency scanning and with a substantial round trip time difference between both beams. (AIP)

57798 Excimer laser with fluoropolymer lining. Sze, R.C. (to Dept. of Energy). US Patent 4,318,056. 2 Mar 1982. Filed date 17 Aug 1978. vp.

PAT-APPL-934763.

A cavity formed of teflon to provide extended static fill lifetimes for gases containing halogens. A double cavity configuration provides structural integrity to the inner teflon cavity by maintaining an identical multi-atmospheric pressure within the outer structural cavity to minimize tension on the teflon inner cavity. Use of a quantity of the lasing gas in the outer cavity or a constituent of that gas minimizes contamination of the lasing gas.

57799 Optically pumped isotopic ammonia laser system. Buchwald, M.I.; Jones, C.R.; Nelson, L.Y. (to Dept. of Energy). US Patent 4,318,057. 2 Mar 1982. Filed date 4 Jun 1979. vp.

PAT-APPL-047550.

An optically pumped isotopic ammonia laser system which is capable of producing a plurality of frequencies in the middle infrared spectral region. Two optical pumping mechanisms are disclosed, I.E., pumping on r(J) and lasing on p(J) in response to enhancement of rotational cascade lasing including stimulated raman effects, and, pumping on r(J) and lasing on p(J+2). The disclosed apparatus for optical pumping include a hole coupled cavity and a grating coupled cavity.

57800 **Double electric discharge coaxial laser.** Stevison, D.F. (to Dept. of the Air Force). US Patent Application 308,975. 6 Oct 1981. 14p.

A novel electrical discharge gas laser device is provided which comprises a pair of laser discharge cavity portions optically interconnected within a U-shaped optical resonant cavity, the laser cavity portions configured to intercommunicate and share a common power supply.

57801 **Corrosion resistant laser mirror heat exchanger.** Gowan, J.G. (to Dept. of the Air Force). US Patent Application 308,976. 6 Oct 1981. 10p.

An improved high energy laser (HEL) mirror is provided wherein the internal surfaces of the molybdenum structure of the mirror defining passageways for water coolant flow are plated with deposition (CVD) techniques described by the invention herein. The mirror is thereby made resistant to the corrosive action of the circulating coolant water on the molybdenum structure comprising the laser mirror.

57802 **E-beam maintained plasma discharge electrodes.** Limpaecher, R. (to Dept. of the Air Force). US Patent Application 306,843. 29 Sep 1981. 18p.

The present invention provides a technique useful in a flowing gas laser designed to satisfy the aforementioned needs. The technique is also useful in chemical processing devices, such as for the generation of ozone or the like. A flowing gas laser utilizes a multilayer gas flow technique wherein laser gas is caused to flow in three distinct layers; an anode gas flow layer flowing adjacent the anode electrode of the laser; a cathode gas flow layer flowing adjacent the cathode electrode of the laser; and a lasing gas flow layer flowing between the anode and cathode layers and through the lasing region of the laser. A higher electron density is produced in the anode and cathode layers than in the middle lasing layer for fostering a higher electric field in the lasering layer and increased electrical efficiency of the laser. The multilayer gas flow technique is also useful in chemical processing devices for generating ozone or the like.

57803 **Low-level losses in ultraviolet laser window materials.** Edwards, D.F. (Los Alamos National Lab., NM); Ochoa, E.; Baumeister, P. *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **288**: 18-20(1981).

The low-level insertion losses have been measured for uv grade CaF_2 and MgF_2 using the multipass reflectometer. These losses include surface absorption and surface losses as well as bulk absorption. Comparing our data with absorption measured by calorimetric methods indicates that insertion losses are dominated by surface effects and bulk properties play only a minor role.

57804 **Out-of-focus intensity distribution: effects of focal number and aberration.** Kyrala, G.A. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **288**: 63-68(1981).

Shock wave experiments contemplated on powerful CO_2 lasers require uniform planar illuminations over spot sizes much larger than the diffraction limit focal spot size of the focusing optics. Cost as well as space considerations limit one's choice of optics to parabolic mirrors with focal lengths between 78 and 150 cm, and apertures to 35 cm. Within these constraints one either modifies the incident laser energy distribution to modify the focal spot shape, or works out of the focal plane. I analyze the latter option using a fast Fourier method to calculate the intensity distributions for two focal lengths (78 and 132 cm) and various measured optical distortions (Phase only) for the focusing optics. I found that a 78 cm element produced more uniform spots of diameter 500 μm. The 132 cm element was less sensitive to focusing/positioning error than the 78 cm element.

57805 **Emission frequencies of the CF_4 laser.** Patterson, C.W.; McDowell, R.S.; Nereson, N.G. (Univ. of California, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-16**: No. 11, 1164-1169(Nov 1980).

104 $(nu_2 + nu_4)$ reverse arrow nu_2 hot-band transitions, some of which correspond to known $(nu_2 + nu_4) \rightarrow nu_2$ CF_4 laser lines, have been identified and measured in high-resolution Doppler-limited spectra of $^{12}CF_4$ near 16 μm, obtained with a tunable diode laser. From an analysis of these frequencies, the rotational and tensor splitting constants for the nu_2 vibrational level have been determined. These constants, together with the $nu_2 + nu_4$ pump-band spectrum previously obtained, allow the laser emission frequencies for any given CO_2 pump line to be calculated with an accuracy of 0.01 to 0.003 cm^{-1}.

57806 **(AD-A—111408/1) Analytical model for predicting gain, intensity and output power of fast speed flowing lasers.** Zhi, G.; Shutao, Z. Translated from *Li Hsueh Hsueh Pao ;* No. 2, 129-138(1980). 24p. (FTD-ID(RS)T—0866-81). NTIS, PC A02/MF A01.

No abstract available.

57807 **Laser beam expander - A new design.** Shafer, D.R. (Perkin-Elmer Corp., Electro-Optical Div., Norwalk, CT). pp 15-20 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

This paper describes a laser beam expander that has three mirrors, one an aspheric, and that is corrected for spherical aberration, coma, astigmatism, and Petzval curvature. It is also unobscured, and features one aspheric mirror used in a centered fashion: no off-axis section of an aspheric mirror needs to be made. The new design can be realized in any beam expansion ratio that is desired, but performance suffers at very high magnifications. Two representative designs, 4X expansion and 8X expansion, are shown and discussed, and their performance numbers are given.

57808 **Efficient optically pumped CF_4 laser system.** Telle, J.M.; Eckhardt, R.C.; Sorem, M.S. (California, University, Los Alamos, NM). pp 270-271 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

A high-resolution TEA CO_2 oscillator-amplifier laser system pumping a CF_4 laser with a 6.0-meter gain length is described. The laser system has achieved 60 mJ of output energy at 615/cm for 0.57 J of 9R12 pump energy. The CF_4 laser output is discussed in terms of pump laser parameters.

57809 **Highly efficient translation of infrared laser wavelengths by microwave electro-optic modulation.** Carter, G.M. (MIT, Lexington, Mass.); Gill, D.H. (California, University, Los Alamos, N. Mex.). pp 316-321 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

Infrared laser frequency translation desirable for photochemistry experiments, laser radar applications, and spectroscopy experiments is demonstrated. Four translators are described, the expected conversion coefficients are analyzed, and experimental results are presented.

57810 Laser pulse shaping on multiple rotational lines. Hauck, J.P.; Mcmullen, J.D.; Hayes, C.L. (Rockwell International Electronics Research Center, Anaheim, CA). pp 322-326 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

We have performed analysis and experiments to demonstrate the feasibility of laser pulse shaping, based on the coherent synthesis of waveforms by phase locked oscillators. The approach is to control the frequency, amplitude and phase of a number of waveguide CO_2 lasers and to synthesize pulses consistent with Fourier analysis. The laser frequency and phase are controlled with a crossover servo which drives a piezo-electric length tuner and an electro-optical crystal modulator. This approach has been demonstrated with a five-laser array producing pulses of a nominal 1.6 ns duration.

57811 Multipulse energy extraction in CO_2 laser amplifiers. Volkin, H.C.; Stark, E.E. Jr. (California, University, Los Alamos, NM). pp 340-343 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

With multipulse energy extraction in electric discharge excited CO_2-laser amplifiers, one can convert a significantly higher fraction of the vibrational energy stored in the gas by the discharge into laser light. The time scale for efficient energy extractions is determined by the collisional transfer rates for the flow of vibrational energy into and among the various vibrational modes of the gas molecules. The collisional processes of interest and optical techniques for implementing the multipulse method are surveyed, and calculated results for a representative case are given. The results indicate that high laser efficiencies, attractive for future commercial applications, can be achieved with CO_2 lasers.

57812 Design and operation of a time-gated optical system for measuring the angular distribution of light emitted from laser targets. Miller, L.W.; Kruse, H.W.; Kruse, P.J.; Bartram, D.E.; Hoffman, N.M.; Mack, J.M. (California, University, Los Alamos, NM). pp 430-437 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 56779, 56780, 56793

57813 (DOE/PC/40280—T4) Parametric performance studies on fluidized-bed heat exchangers. Quarterly technical progress report, 1 April-30 June 1982. (United Technologies Research Center, East Hartford, CT (USA)). Jul 1982. Contract AC22-81PC40280. 11p. NTIS, PC A02/MF A01. Order Number DE82019521.

In the previous report period, the effects of water condensate on fluidized bed heat exchanger performance was investigated. During the quarter ending 30 June 1982 the Fluidized Bed Heat Exchanger (FBHEX) was tested using glycerol injection, thus completing the experimental portion of Task 1. The results obtained with glycerol injection were similar to those obtained with water injection and may be summarized as follows: (1) Heat exchanger performance is seriously degraded when the dew point temperature exceeds the heat exchanger surface temperature. (2) The performance decrease occurs as a result of particle adherence to the heat exchanger and not as a result of particle agglomeration. However, when the dew point becomes greater than the bed temperature, the bed particles agglomerate resulting in the cessation of all fluidization. (3) Increase in bed fluidization (increase of superficial velocity) does not alter the manner in which condensation affects the heat exchanger performance. (4) Original heat exchanger performance can be reattained after condensation has occurred by operating the bed in the dry state for 5 to 6 hours. This allows the residual glycerol to evaporate and the scrubbing action of the bed to abrade away bed particles which had adhered to the heat exchanger surface.

57814 (LA-UR—82-1291) Flow regimes. Liles, D.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-820614—2). NTIS, PC A02/MF A01. Order Number DE82015811.

From 9. US national congress of applied mechanics; Ithace, NY, USA (21 Jun 1982).

Internal boundaries in multiphase flow greatly complicate fluid-dynamic and heat-transfer descriptions. Different flow regimes or topological configurations can have radically dissimilar interfacial and wall mass, momentum, and energy exchanges. To model the flow dynamics properly requires estimates of these rates. In this paper the common flow regimes for gas-liquid systems are defined and the techniques used to estimate the extent of a particular regime are described. Also, the current computer-code procedures are delineated and introduce a potentially better method is introduced.

57815 (SAND—82-0526C) Design method for the flow field and drag of bodies of revolution in incompressible flow. Wolfe, W.P.; Oberkampf, W.L. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 10p. (CONF-820805—3). NTIS, PC A02/MF A01. Order Number DE82020036.

From AIAA atmospheric flight mechanics conference; San Diego, CA, USA (9 Aug 1982).

Portions of document are illegible.

A design method has been developed for determining the flow field, pressure distribution, boundary layer separation point, and drag of bodies of revolution at zero angle of attack in incompressible flow. The approach taken is the classical coupling of potential and boundary solutions to obtain the flow field about the body. The potential solution is obtained by modeling the body with an axial distribution of source/sink elements whose strengths vary linearly along their length. The laminar and turbulent boundary layer solutions are obtained from conventional solutions of the momentum integral equation. An approximate method is used to estimate the boundary layer transition point on the body. An empirical base pressure correlation is used to determine the base drag. Body surface pressure distributions and drag predictions are compared with experimental measurements.

57816 (SAND—82-0666C) Comparison of reentry-vehicle dynamic models for the estimation of nonsymmetrical aerodynamic coefficients. McDowell, J.L.; Williamson, W.E. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 8p. (CONF-820805—2). NTIS, PC A02/MF A01. Order Number DE82020037.

From AIAA atmospheric flight mechanics conference; San Diego, CA, USA (9 Aug 1982).

Two different mathematical models are used to estimate the aerodynamic coefficients for a reentry vehicle. One model assumes that the aerodynamic coefficients are symmetric and the other does not. An actual reentry vehicle develops an asymmetric shape as the heatshield and nosetip ablate. A comparison of the two models is made as a function of the aerodynamic asymmetry to illustrate the errors made in using the symmetric model when the aerodynamics are asymmetric. The asymmetric model is shown to always be capable of correctly estimating the asymmetric aerodynamic coefficients for the simulations considered in this paper.

57817 Stefan problem with a convective boundary condition. Solomon, A.D.; Alexiades, V.; Wislon, D.G. (Union Carbide Corporation, Oak Ridge). *Quarterly of Applied Mathematics;* **40**: No. 2, 203-218(Jul 1982). Contract W-7405-ENG-26.

We study the one-phase Stefan problem on a semi-infinite strip x> or =0, with the convective boundary condition -KT/sub x/(0,t) = h[T/sub L/—T(0,t)]. Points of intrest include: a) behavior of the surface temperature T(0,t); b) asymptotic behavior as h→∞;

c) uniqueness, and d) bounds on the phase change front and total system energy.

57818 **Instability mechanisms and stability criteria of a group of circular cylinders subjected to cross-flow.** Chen, S.S. (Argonne National Lab., IL). *American Society of Mechanical Engineers, [Paper];* No. 81-DET-21, vp(Sep 1981).

A mathematical model is presented for a group of circular cylinders subject to cross-flow. It is found that there are two basic dynamic instability mechanisms: instability controlled by fluid damping and instability controlled by fluidelastic force. Approximate closed form solutions of the critical flow velocity for the two mechanisms are obtained based on constrained-mode analyses. The model has identified the key parameters in the stability criteria and their functional forms and resolved the controversy associated with the empirical stability criteria. 19 refs.

57819 **Instability mechanisms and stability criteria of a group of circular cylinders subjected to cross flow. 2. Numerical results and discussions.** Chen, S.S. (Argonne National Lab., IL). *American Society of Mechanical Engineers, [Paper];* No. 81-DET-22, vp(Sep 1981).

The fluid-force coefficients for a row of cylinders and a square array are determined from available experimental data and critical flow velocities are calculated as a function of system parameters. Experimental data for critical flow velocities are found to be in good agreement with the analytical results. It is concluded that different stability criteria have to be utilized in different parameter ranges because of different instability mechanisms. 25 refs.

57820 **Statistical properties of the surface pressure distribution on a yawed cylinder in a turbulent flow field.** Sax, M.J.; Plunkett, R. (Westinghouse Electr Corp, West Miflin, PA). *American Society of Mechanical Engineers, [Paper];* No. 81-DET-35, vp(Sep 1981).

The power spectral density of the displacement of a structure is calculated where the complete second-order statistics for the fluctuating surface pressure field are known. This paper describes an experimental program whose objective was to measure and parameterize those statistics on a yawed circular cylinder subjected to an isotropic, homogeneous turbulent flow. 26 refs.

57821 **A method of lines approach to the numerical solution of conservation laws.** Hyman, J.M. (California University, Los Alamos, N. Mex.). pp 313-321 of Advances in computer methods for partial differential equations. III. Proceedings of the third international symposium, Bethlehem, PA, June 20-22, 1979. New Brunswick, NJ; International Association for Mathematics and Computers in Simulation (1979).

From 3. IMACS international symposium on computer methods for partial differential equation; Bethlehem, PA, USA (20 Jun 1979).

In the present paper, an MOL approach is followed in order to construct accurate and robust numerical methods for hyperbolic PDEs derived from conservation laws. The approach is shown to lead to new methods for the Euler equations. It is proposed that a similar approach may yield some equally useful methods in other areas of numerical analysis such as the Navier-Stokes equations, reacting or combusting flows and nonlinear diffusion equations.

4205 Materials Testing

REFER ALSO TO CITATION(S) 56430, 56706, 57306, 57406, 57409, 57762, 57763

57822 **(AD-A—109644/5) Some analytic models for quasi-static source region EMP: application to nuclear lightning. Topical report, 5 January-1 November 1980.** Grover, M.K. (R and D Associates, Santa Monica, CA (USA)). 1 Nov 1980. 58p. (RDA-TR—113202-002). NTIS, PC A04/MF A01.

Analytic solutions and numerical results are obtained for three models for quasi-static source region EMP from a nuclear surface burst, representing electron-dominated air conductivity, ion-dominated air conductivity, and an intermediate situation with electron-dominated conductivity at short ranges and ion-dominated conductivity at long ranges. Comparisons are made with the results of previous approximate analyses and with the gross features of lightning strokes which were observed in the 1- to 10-ms time frame on the Mike shot. Uncertainties in air chemistry and ionization rate parameters give rise to roughly + or - 50 percent uncertainties in electric field strength and roughly factor-of-three uncertainties in the applicable time frame for each of the above-mentioned models. Within these uncertainties, the EMP predictions appear to be consistent with the gross features of the observed lightning.

57823 **Nondestructive acoustic electric field probe apparatus and method.** Migliori, A. (to Department Of Energy). US Patent 4,326,417. 27 Apr 1982. Filed date 8 Aug 1980. vp.

PAT-APPL-176441.

The disclosure relates to a nondestructive acoustic electric field probe and its method of use. A source of acoustic pulses of arbitrary but selected shape is placed in an oil bath along with material to be tested across which a voltage is disposed and means for receiving acoustic pulses after they have passed through the material. The received pulses are compared with voltage changes across the material occurring while acoustic pulses pass through it and analysis is made thereof to determine preselected characteristics of the material.

57824 **Neutron diffraction tomography: a unique 3D inspection technique for crystals using an intensifier TV system.** Davidson, J.B.; Case, A.L. (Oak Ridge Natl Lab, TN). *American Society for Testing and Materials, Special Technical Publication;* No. 716, 251-263(1980). (CONF-780555—).

From Symposium on real-time radiologic imaging: Medical and industrial applications; Gaithersburg, MD, USA (8 May 1978).

The application of phosphor-intensifier-television (TV) techniques to neutron topography and tomography of crystals is described. In neutron diffraction tomography (or section topography), a collimated beam irradiates a slice (0.5 to 10 mm) of the crystal. The diffracted image is a tomogram from this part only. A series of tomograms covering the crystal can be taken as the specimen is translated in steps across the narrow beam. Grains, voids, twinning, and other defects from regions down to 1 mm in size can be observed and isolated. Although at present poorer in resolution than the original neutron and film methods, the TV techniques are much faster and, in some cases, permit real-time viewing. 15 refs.

57825 **(PB—82-155615) A study of inspection systems for welded products. Part 6: slag inclusions in butt-welds. Measured width.** Hansen, B. (Svejsecentralen, Glostrup (Denmark)). [nd]. 12p. NTIS, PC A02/MF A01.

This publication reports the results from radiographic examination of a number of butt welds. The width of slag inclusions in the welds were determined from the radiographs. (Copyright (c) The Danish Welding Institute 1978.)

57826 **(PB—82-155631) A study of inspection systems for welded products. Part 8: lack of penetration in a butt-weld. Measured height.** Hansen, B. (Svejsecentralen, Glostrup (Denmark)). [nd]. 14p. NTIS, PC A02/MF A01.

A research project with the purpose of studying inspection systems for welded products demands determination of the statistical distribution of defects in welds. This publication reports the results from an examination of a butt-weld with defects of the lack of penetration type. (Copyright (c) The Danish Welding Institute 1978.)

4206 Safety Engineering

REFER ALSO TO CITATION(S) 57010

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 56751, 57015, 57471, 57576, 58005, 58007, 58011

57827 **(FUPH-R—172) Spark-gap-triggered RLC circuits.** Hugrass, W.N.; Jessup, B.L.; Pugatschew, A.A. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Mar 1981. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82904621.

There is always a voltage drop between the electrodes of a triggered gas filled spark gap. It is shown that the magnitude of this voltage, its form and frequency can have a dramatic effect on the damping of a triggered RLC circuit. Energy can be fed to such an oscillating circuit by externally controlling the frequency of the spark gap voltage drop waveform. The dependence of this energy transfer on the amplitude, frequency and polarity of the gap voltage drop is examined experimentally and theoretically with the aid of numerical calculations. The conclusions of this study are applied to reducing the damping influence of a spark gap and to the construction of a circuit to generate pulses of r.f. oscillations.

57828 **(PNL—4335) Improved manufacturing techniques for rf and laser hardening of missile domes. Phase I. Technical report.** Pawlewicz, W.T.; Mann, I.B.; Martin, P.M.; Hays, D.D.; Graybeal, A.G. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 73p. NTIS, PC A04/MF A01. Order Number DE82020117.

This report summarizes key results and accomplishements during the first year of a Manufacturing Methods and Technology project to adapt an existing Pacific Northwest Laboratory (PNL) optical coating capability developed for high-power fusion-laser applications to the case of rf and laser hardening of plastic missile domes used by the US Army (MICOM). The primary objective of the first year's work was to demonstrate rf hardening of Hellfire and Copperhead 1.06-micron missile domes by use of transparent conductive Indium Tin Oxide (ITO) coatings. The project thus involved adaptation of a coating material and process developed for flat glass components used in fusion lasers to the case of hemispherical or conical heat-sensitive plastic domes used on laser-guided missiles. Specific ITO coating property goals were an electrical sheet resistance of 10 Ohms/square, a coated-dome transmission of 80% or more at 1.06 micron wavelength (compared to 90% for a bare dome), and good adhesion. The sheet resistance goal of 10 Ohms/square was expected to result in an rf attenuation of 30 dB at the frequencies of importance.

57829 **(SAND—80-2764) Development of the MC3344 Fluorinert/Mylar energy storage capacitor.** Mauldin, G.H. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1981. Contract AC04-76DP00789. 76p. NTIS, PC A05/MF A01. Order Number DE82006874.

Portions of document are illegible.

The specific development program of the MC3344 capacitor for use in the fireset of the W-80 is described. Also the state of the art of the Fluorinert/Mylar capacitor technology at the achievement of production status is recorded.

57830 **(SAND—81-2489) Filter characterization.** Stanton, C.P. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1982. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01. Order Number DE82020466.

Some insight into the characteristic response of filters versus frequency and loading is presented. A computer program is provided which will allow the user to vary the filter model in order to assess the effect of specific conditions.

57831 **High-speed ultraviolet and x-ray-sensitive InP photoconductive detectors.** Deutsch, T.F.; Leonberger, F.J.; Foyt, A.G.; Mills, D. (Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts 02173). *Applied Physics Letters;* **41**: No. 5, 403-405(1 Sep 1982).

The performance of iron-doped InP photoconductive detectors in the optical and x-ray spectral regions is compared. The detectors show uniform, high cw quantum efficiency from 900 to 200 nm. Pulse response times at 193 nm are laser source limited to < or =12 ns. The response to ~9-keV-fast x-ray pulses indicates device rise times <90 ps.

57832 **Current and magnetic field penetration into a plasma: Application to high power-density flow in transmission lines.** Baker, L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **53**: No. 8, 5931-5935(Aug 1982).

When a material is heated sufficiently to cause a conducting plasma to blow off, the resulting layer shields this material from magnetic fields and currents that may be present. Theoretical considerations relevant to the simulation of such situations are discussed. Results are presented for the problem of current flow in transmission lines undergoing surface blowoff due to high current densities. For a typical case of interest only 10% of the current is found to flow in the plasma blowoff. Moreover, the transmission-line properties are not substantially changed on time scales of interest.

57833 **Device for detecting imminent failure of high-dielectric stress capacitors.** McDuff, G.G. (to Department Of Energy). US Patent 4,330,777. 18 May 1982. Filed date 5 Nov 1980. vp.

PAT-APPL-204121.

A device for detecting imminent failure of a high-dielectric stress capacitor utilizing circuitry for detecting pulse width variations and pulse magnitude variations. Inexpensive microprocessor circuitry is utilized to make numerical calculations of digital data supplied by detection circuitry for comparison of pulse width data and magnitude data to determine if preselected ranges have been exceeded, thereby indicating imminent failure of a capacitor. Detection circuitry may be incorporated in transmission lines, pulse power circuitry, including laser pulse circuitry or any circuitry where capacitors or capactior banks are utilized.

57834 **Multichannel homodyne receiver.** Landt, J.A. (to Dept. of Energy). US Patent Application 226,283. 19 Jan 1981. 28p. Contract W-7405-ENG-36.

Portions of document are illegible.

A homodyne radar transmitter/receiver device which produces a single combined output which contains modulated backscatter information for all phase conditions of both modulated and unmodulated backscatter signals is described. The device utilizes taps along coaxial transmission lines, strip transmission line, and waveguides which are spaced by 1/8 wavelength or 1/6 wavelength, etc. This greatly reduces costs by eliminating separate transmission and reception antennas and an expensive arrangement of power splitters and mixers utilized in the prior art.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 57258

57835 **(ORNL/MIT—342) Modeling of an ANFLOW municipal waste-treatment unit.** Halbert, D.J.; Wojtowicz, R.J. (Oak Ridge National Lab., TN (USA); Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice). Jun 1982. Contract W-7405-ENG-26. 69p. NTIS, PC A04/MF A01. Order Number DE82016617.

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A computer simulation program was written to model ANFLOW, an anaerobic, upflow, packed-bed bioreactor, developed at Oak Ridge National Laoratory. The dynamic model predicts sludge-accumulation rates, effluent liquid composition, and effluent gas flow rate and composition as a function of time following a change in inlet flow rate or composition. The ANFLOW reactor was modeled as a settling tank and a series of continuous stirred-tank reactors (CSTRs). The reaction scheme and kinetic expressions for anaerobic digestion, adopted from the literature, were based on Monod kinetics for acetogenesis and inhibition kinetics for methanogenesis. Detailed descriptions of the simulation program, its use, and suggestions for its improvement are included.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 56050, 56101, 56102, 56103, 56180, 56460

57836 **(AD-A—110215/1) Feasibility study on the conversion of Air Force oil-fired heat plants to coal-oil-mixture fired plants. Master's thesis.** Pokora, E.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1981. 99p. (AFIT-LSSR—75-81). NTIS, PC A05/MF A01.

The Air Force is the primary Department of Defense user of petroleum based fuels for the operation of its aircraft, facilities and other support equipment. Alternative energy sources must be explored and utilized to minimize the cost to the Air Force for these fuels. This research explored the feasibility of mixing coal with oil to produce a mixture capable of being burned in existing Air Force boilers. Four technologies were examined by comparing relative Life-Cycle Costs for retro-fitting existing boilers and also by means of applying a standardized questionnaire to case studies. This research concluded that of the four current technologies available for mixing coal in oil, the ultrafine coal-oil mixture process would be the best suited for central plant boilers such as those that exist on Air Force installations.

57837 **(DOE/NASA/0146—1) Low NO/sub x/ heavy fuel combustor concept program. Phase I. Combustion technology generation. Final report.** Lew, H.G.; Carl, D.R.; Vermes, G.; DeZubay, E.A.; Schwab, J.A.; Prothroe, D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Oct 1981. Contract AI01-77ET13111. 142p. (NASA-CR—165482). NTIS, PC A07/MF A01. Order Number DE82015492.

This report documents the results of a DOE/NASA sponsored project to conceptualize, design and demonstrate the viability of low emission (NO/sub x/) gas turbine combustors for industrial and utility application. Thirteen different concepts were evolved and most were tested. Acceptable performance was demonstrated for four of the combustors using ERBS fuel and ultra-low NO/sub x/ emissions were obtained for lean catalytic combustion. Residual oil and coal derived liquids containing fuel bound nitrogen were also used at test fuels, and it was shown that staged rich/lean combustion was effective in minimizing the conversion of FBN to NO/sub x/. The rich/lean concept was tested with both modular and integral combustors. While the ceramic lined modular configuration produced the best results, the advantages of the all-metal integral burners make them candidates for future development. An example of scaling the laboratory-sized combustor to an 100 MW size engine is included in the report as are recommendations for future work.

57838 **(DOE/NASA/0147—1) Low NO/sub x/ Heavy Fuel Combustor Concept Program. Phase I. Final report.** Cutrone, M.B. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Oct 1981. Contract AI01-77ET13111. 248p. (NASA-CR—165449). NTIS, PC A11/MF A01. Order Number DE82014967.

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Six combustor concepts were designed, fabricated, and underwent a series of combustion tests with the objective of evaluating and developing a combustor capable of meeting US New Source Performance Standards (NSPS), dry, for high-nitrogen liquid fuels. Three rich/lean and three lean/lean two-stage combustors were tested with ERBS distillate, petroleum residual, and SRC-II coal derived liquid (CDL) fuels with fuel-bound nitrogen contents of 0.0054, 0.23, and 0.87 weight percent, respectively. A lean/lean concept was demonstrated with ultralow NO/sub x/ emissions, dry, of 5 gm NO/sub x/kg fuel on ERBS, and NO/sub x/ emissions meeting the NSPS NO/sub x/ standard on residual fuel. This combustor concept met operational goals for pressure drop, smoke, exhaust pattern factor, and combustion efficiency. A rich/lean concept was identified and developed which demonstrated NO/sub x/ emissions approaching the NSPS standards, dry, for all liquid fuels including the 0.87 weight percent nitrogen SRC-II coal-derived liquid. Exhaust pattern factor and pressure drop met or approached goals. Smoke emissions were higher than the program goal. However, a significant improvement was made with only a minor modification of the fuel injector/air swirler system, and further development should result in meeting smoke goals for all fuels. Liner metal temperatures were higher than allowable for commercial application. Conceptual designs for further development of these two rich/lean and lean/lean concepts have been completed which address smoke and metal temperature concerns, and are available for the next phase of this NASA-sponsored, DOE-funded program. Tests of a rich/lean concept, and a catalytic combustor concept using low- and intermediate-Btu simulated coal-derived gases will be completed during the ongoing Phase IA extension of this program.

57839 **(DOE/NASA/0148—1) Low NO/sub x/ heavy fuel combustor concept program.** Novick, A.S.; Troth, D.L. (General Motors Corp., Indianapolis, IN (USA). Detroit Diesel Allison Div.). Oct 1981. Contract AI01-77ET13111. 205p. (NASA-CR—165367; DDA-EDR—10594). NTIS, PC A10/MF A01. Order Number DE82015840.

Portions of document are illegible.

The purpose of this program was to develop the dry technology required to operate an industrial gas turbine combustion system on minimally processed, heavy petroleum or residual fuels having high levels of fuel-bound nitrogen (FBN) while producing acceptable levels of exhaust emissions. Also, a combustor utilizing this technology was to be fabricated and tested to demonstrate fuel flexibility and low exhaust emissions in a combustor rig tests. For this program Detroit Diesel Allison (DDA) chose its Model 570-K industrial gas turbine engine as the candidate engine to receive this technology. Three fuels were supplied for the combustor test demonstrations: a typical middle distillate fuel represented by the Experimental Referee Broad Specification (ERBS) fuel, a heavy residual fuel, and a synthetic fuel represented by a coal derived liquid SRC-II (Solvent Refined Coal) fuel. Three combustor concepts were designed and fabricated to achieve fuel flexibility with low exhaust emissions. The primary concept was an air staged, variable-geometry combustor designed to produce low emissions from fuels having high levels of FBN. This combustor used a long residence time, fuel-rich primary combustion zone followed by a quick-quench air mixer to rapidly dilute the fuel rich products for the fuel-lean final burnout of the fuel. This combustor, called the Rich/Quench/Lean (RQL) combustor, was extensively tested using each fuel over the entire power range of the Model 570-K engine. Also, a series of parametric tests was conducted to determine the combustor's sensitivity to rich-zone equivalence ratio, lean-zone equivalence ratio, rich-zone residence time, and overall system pressure drop. The RQL combustor was very successful in achieving program goals. Minimum nitrogen oxide emissions (NO/sub x/) were measured at 50 to 55 ppMv at maximum continuous power for all three fuels. Smoke was less than a 10 SAE smoke number.

57840 **(DOE/NASA/3230—1) Transient catalytic combustor model.** T'ien, J.S. (Case Western Reserve Univ., Cleveland, OH (USA)). May 1981. Contract AI01-77CS51040. 81p. (NASA-CR—165324). NTIS, PC A05/MF A01. Order Number DE82006053.

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A lean combustion model for monolithic catalytic combustors is given. The model, consisting of several semi-global chemical reaction steps in the gas phase and on the surface, is capable of analyzing CO and THC emissions and combustor efficiency in both steady and unsteady states. In the steady-state model computation presented, the influence of operating and design parameters on the minimum combustor length is studied. Special attention is given to the effect of after-bed gas phase reaction space. Comparison with experimental data by Anderson indicates good agreement in the range of parameters covered. In the transient analysis, a quasisteady gas phase and a thermally-thin substrate are assumed. The combustor response delay is due to the substrate thermal inertia. Fast response is found to be favored by thin substrate, short catalytic bed length, high combustor inlet and final temperatures and, in most cases, small gas channel diameters. The calculated gas and substrate temperature time history at different axial positions provide an understanding of how the catalytic combustor responds to an upstream condition change. The computed results also suggest that the gas residence times in the catalytic bed and in the after-bed space are correlatable with the nondimensional combustor response time. When fast transient responses are required, both steady and unsteady studies have to be made to achieve a meaningful compromising design.

57841 **Fluidized-bed boilers for industrial sized power house.** Siskind, W. (US DOE, Washington, DC, USA). *Industrial Fuel Conference;* 18(1980). (CONF-8010275—).

From Industrial fuel conference; West Lafayette, IN, USA (7 Oct 1980).

This paper is concerned with fluidized-bed combustion in which a contained mass of solid particles is transformed into a pseudo fluid state by a vertical stream of air passing through it. The force of the air velocity on the particles must be sufficiently great to counteract gravitational forces but not so great as to transport the entire bed of particles along with the air stream. Under these conditions, the bed of solid particles behaves as a highly turbulent, boiling, fluid. A brief review of legislative requirements related to environmental protection is followed by description of fluidized-bed boilers design along with their operations.

4220 Underground Engineering

57842 **(SAND—82-0963) RUNNOS and RUNDEP: computer programs for calculating loads on earth penetrators.** Norwood, F.R. (Sandia National Labs., Albuquerque, NM (USA)). May 1982. Contract AC04-76DP00789. 22p. NTIS, PC A02/MF A01. Order Number DE82016579.

Portions of document are illegible.

RUNNOS and RUNDEP are computer codes for predicting penetrator performance. More specifically, RUNNOS may by used to compute total force and deceleration, plus normal stress distribution and the target-penetrator gap along the length of the penetrator, while RUNDEP provides a history of deceleration as a function of penetration depth. The coding allows for ogival, conical and cylindrical regions of the penetrator, and accounts for possible separation and reattachment. In addition, the imput required for these codes is much simpler than the input required for comparable codes. The simplification of the input was accomplished both by fixing appropriately several of the input parameters and by modifying the coding accordingly. A wide choice of constitutive relations are provided, and the material constant required may be obtained from standard experimental material data.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 56576

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 56032, 56034, 56180, 57837, 57838, 57840, 58079

57843 **(CONF-820256—1) Design of experiments to assess gas-composition effects on electron-beam ionization.** Tokunaga, O. (Florida State Univ., Tallahassee (USA)). 1982. Contract AC21-81MC16229. 15p. NTIS, PC A02/MF A01. Order Number DE82019410.

From Electron beam workshop; Arlington, VA, USA (25 Feb 1982).

Utilization of electron beam ionization for particle precipitation in conventional systems or in combined treatment systems depends upon the properties of gases subjected to irradiation. The properties of the gases become even more important where secondary ionization is to be used, since the magnitude and stability of secondary ionization currents are governed by attachment of free electrons to component molecule and ionic recombination reaction of electrons. Since stack gases are oxygen depleted and further since the gases in the electron beam treatment systems contain variable amounts of other gases, a series of experiments have been initiated for a study to investigate on the electron beam ionization for a number of model gases. Results are discussed. (WHK)

57844 **(DIB—79-09-515) The Greek market for air and water pollution control equipment. Foreign market survey report.** (ICAP Hellas S.A., Athens (Greece)). Sep 1979. 87p. NTIS PC$15.00/MF A01.

The market research was undertaken to study the present and potential US share of the market in Greece for air and water pollution control equipment; to examine growth trends in Greek end-user industries over the next few years; to identify specific product categories that offer the most promising export potential for US companies; and to provide basic data which will assist US suppliers in determining current and potential sales and marketing opportunities. The trade promotional and marketing techniques which are likely to succeed in Greece were also reviewed.

57845 **(PB—82-166521) Development and testing of a prototype device to provide air meeting the Occupational Safety and Health Act of 1970. Final report.** Rodgers, S.J.; Roehlich, F.; Polite, E. (MSA Research Corp., Evans City, PA (USA)). 31 Jan 1973. 32p. (MSAR—73-13). NTIS, PC A03/MF A01.

The objective of this program was to develop and test a purification device designed to provide clean air, as defined in the Occupational Safety and Health Act of 1970, to personnel exposed to automotive exhaust contaminants. Specifically, an air cleaning unit has been assembled which will remove or greatly reduce the levels or concentrations of carbon monoxide, hydrocarbons, nitrogen dioxide, dust or particulate matter, and heat/humidity. Design criteria for the unit were based on the results of previous research studies and analyses of numerous air samples. Unit components are standard or off the shelf items. However, extensive modifications were required in the air cooling system. The completed unit was tested first in a closed 4300 cubic foot chamber and then extensively in the Lincoln Tunnel, a congested traffic artery beneath the Hudson River. This final report summarizes the design and construction of both the air cleaning unit and the analytical module subsequently used to monitor the inlet and outlet air quality. Test results of the completed unit are reported.

4250 Power Cycles

REFER ALSO TO CITATION(S) 57252

57846 **(NASA-CR—165473) Evaluation of the potential of the Stirling engine for heavy duty application. Final report.** Meijer, R.J.; Ziph, B. (Stirling Thermal Motors, Inc., Ann Arbor, MI (USA)). Oct 1981. 62p. NTIS, PC A04/MF A01.

A 150 hp four cylinder heavy duty Stirling engine was evaluated. The engine uses a variable stroke power control system, swashplate drive and ceramic insulation. The sensitivity of the design to engine size and heater temperature is investigated. Optimization shows that, with porous ceramics, indicated efficiencies as high as 52% can be achieved. It is shown that the gain in engine efficiency becomes insignificant when the heater temperature is raised above 200°F.

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 57084, 59041

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 58588, 58589, 58593, 58960

57847 **(INIS-mf—7100) Annual report, scientific activities, 1979.** (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Dec 1980. 136p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780706.

At TRIUMF in 1979 cyclotron availability approached 88 percent and 100 μA operation became routine. Tests showed a beam-energy resolution of 10^{-3} was possible and a trial run at a current of 150 μA on beam line 1 was successful. The integrated current delivered during the year was increased by a factor of over three. A new primary beam line, 1B, became available for use during polarized-beam operation, and the extraction of a 70-100 MeV beam was demonstrated. The nucleon-nucleon scattering program completed measurements for dewermining Wolfstein parameters at 200-500 MeV. Clinical tests in negative pion cancer therapy were started. Federal government funding increased from $10,513,000 in 1978-79 to $11,204,040 in 1979-80.

57848 **(INIS-mf—7104) Progress report, 1980.** (McGill Univ., Montreal, Quebec (Canada). Foster Radiation Lab.). 1980. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780709.

The operation and development of facilities in the Foster Radiation Laboratory and the research carried out from November 1979 to October 1980 are summarized. The upgrading process for the synchrocyclotron is continuing. The main research activities are the studies of nuclear properties far from beta stability, complex nuclear reactions, the nuclear fission mechanism, and positron emission tomography. A mini-cyclotron is being installed at the Montreal Neurological Institute. Lists of personnel and publications are included.

57849 **Recent advances in collective ion accelerators.** Reiser, M. (Univ of Md, College Park). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3355-3359(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The main developments in the field of collective effect accelerators during the past decade are briefly reviewed, and areas of major progress are discussed. Important advances were made in vacuum drift tubes with localized ion source and wave accelerators. Recent results of the successful acceleration of heavy ions at the University of Maryland are described. 28 refs.

57850 **Particle beam fusion accelerator-I (PBFA-I).** Martin, T.H.; VanDevender, J.P.; Barr, G.W.; Goldstein, S.A.; White, R.A.; Seamen, J.F. (Sandia Natl Lab, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3365-3369(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The first Particle Beam Fusion Accelerator (PBFA-I) has recently completed its operational series of tests. It provided 30 TW into 36 power flow lines terminated in electron beam loads at the accelerator's center. The outputs were 2 MV at 15 MA for a 40 ns pulse which provided 1 MJ of output energy. During the accelerator development, several ways of modifying and reconnecting this modular, few MV output pulsed power were discovered. The data from PBFA-I tests show the flexibility and reliability of pulsed power. This technology base could provide a 100 TW accelerator known as PBFA-II which will be the light ion beam test bed for breakeven experiments for the Department of Energy's Inertial Confinement Fusion Program. 9 refs.

57851 **Collective acceleration of light and heavy ions.** Destler, W.W.; Floyd, L.E.; Cremer, J.T.; Parsons, C.R.; Reiser, M.; Rudmin, J.W. (Univ of Md, College Park). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3404-3406(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The collective acceleration of ions (H, D, He, C, N, Ne, Al, Ar, Fe, Cu, Xe) from a well localized plasma immediately downstream of a relativistic electron beam diode is experimentally investigated. The ions are produced either by electron impact on a well confined gas cloud from a fast rise puff valve or by a high power (10J, 15ns), Q-switched ruby laser pulse incident on solid material. Peak ion energies up to 5 MeV/nucleon were observed using a 1.5 MeV, 35 kA, 30 ns electron beam pulse. Ion energy diagnostics include nuclear activation, range-energy/track etching, and time of flight measurements. The effect of a strong applied axial magnetic field (1-10 kilogauss) on the acceleration process is also studied. 11 refs.

57852 **Laser beam accelerator.** Tajima, T.; Dawson, J.M. (Univ of Tex, Austin). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3416-3417(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Parallel intense photon (laser, microwave, etc.) beams /omega/sub //0, k/sub 0/ and /omega/sub //1, k/sub 1/ shone on a plasma with frequency separation equal to the plasma frequency /omega/sub //p is capable of accelerating plasma electrons to high energies in large flux. The photon beat excites through the forward Raman scattering large amplitude plasmons whose phase velocity is equal to (/omega/ /sub 0/-/omega/sub //1)/(k/sub 0/-k/sub 1/), close to c in an underdense plasma. The multiple forward Raman instability produces smaller and smaller frequency and group velocity of photons; thus the photons slow down in the plasma by emitting accelerated electrons (inverse Cherenkov process). 6 refs.

57853 **Superconducting heavy-ion linac at Argonne.** Aron, J.; Benaroya, R.; Bollinger, L.M.; Clifft, B.G.; Johnson, K.W.; Nixon, J.M.; Markovich, P.; Pardo, R.C.; Shepard, K.W. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3458-3460(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The design, status, and performance of the first operating superconducting heavy-ion accelerator, a linac used to boost the energies of beams from a 9-MV tandem, is summarized. When completed in 1981, the linac will consist of 24 independently-phased splitring niobium resonators operating at 97 MHz. This linac is designed to provide 29 MV of acceleration. Because of the modular character of the system, the linac has been operable and useful since mid-1978, when a beam was accelerated through 2 units and the first nuclear-physics experiments were performed. Now, 16 resonators are in use, and a beam has been accelerated for approximately 6000 hr. 6 refs.

57854 **Relevance of accelerator/storage ring technological developments to U.S. science and technology - past, present and future.** Leiss, J.E. (US DOE, Washington, DC). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3553-3555(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A discussion is presented of past and present contribution of accelerator development. An assessment is also made of future contributions.

57855 **Tune control improvements on the rapid cycling synchrotron.** Potts, C.; Faber, M.; Gunderson, G.; Knott, M.; Voss, D. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3020-3022(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The as-built lattice of the Rapid Cycling Synchrotron (RCS) had two sets of correction sextupoles and two sets of quadrupoles energized by dc power supplies to control the tune and the tune tilt. With this method of powering these magnets, adjustment of tune conditions during the accelerating cycle as needed was not possible. A set of dynamically programmable power supplies has been built and operated to provide the required chromaticity adjustment. The short accelerating time (16.7 ms) of the RCS and the inductance of the magnets dictated large transistor amplifier power supplies. The required time resolution and waveform flexibility indicated the desirability of computer control. Both the amplifiers and controls are described, along with resulting improvements in the beam performance. 5 refs.

57856 **Improving regulation in the Fermilab main ring magnet power supply system.** Wolff, D.; Pfeffer, H.; Briegel, C.; Dinkel, J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3088-3090(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

In the past two years a number of changes have been made to the Main Ring Magnet Power Supply System to improve current regulation and long term drift. Some of the modifications discussed include new computers, new passive filters, direct analog feedback, a voltage-to-frequency converter for bend bus regulation, and a "smart" Nuclear Magnetic Resonance probe. Among the improvements described are the attenuation of power supply ripple by a factor of five and the reduction of long term flattop drift by an order of magnitude. 2 refs.

57857 **Progress in superconducting magnet technology for accelerators/storage rings.** Tollestrup, A.V. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3198-3199(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The progress on the Energy Saver is briefly described. A description of some of the "hard lessons" is given, and a short comparison of the two-shell dipole versus the "cos /theta/" form is made.

57858 **Early history of particle accelerators.** Livingston, M.S. (Los Alamos Scientific Lab., NM). *Advances in Electronics and Electron Physics;* **50**: 1-88(1980).

The historical background of the field of particle accelerators is presented with a description of the conceptual and technical growth of each of the major types. First, the status of high-voltage technology before accelerators were conceived is described. This shows the technical knowledge available to the earliest generation of accelerator builders. Next, a description of the origins and early development of each major accelerator type is given. (SC)

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 57932, 57942, 57943

57859 **(AD-A—111198/8) Filamentation instability of a relativistic hollow electron beam. Final report.** Uhm, H.S.; Siambis, J.G. (Naval Surface Weapons Center, Silver Spring, MD (USA)). Sep 1981. 38p. NTIS, PC A03/MF A01.

The filamentation instability properties of a relativistic hollow electron beam confined in axial flow by a uniform magnetic field in a pipe are investigated via the Vlasov-Maxwell equations. The instability is found to have two side-bands, one with a spectrum of positive wavenumbers k and the other with a spectrum of negative wavenumbers. The spectral point $k=0$, associated with the diokotron instability, is excluded from the filamentation instability's two unstable sidebands. Only in the limit of zero axial beam flow, the diokotron instability becomes asymptotically part of the filamentation instability spectrum. In this limit the filamentation instability's two sidebands merge asymptotically and symmetrically toward the diokotron instability spectral point, $k=0$, in agreement with the basic driving physical mechanisms and geometry configurations for these two distinct and different instabilities.

57860 **(DOE/ER/40003—1) Dissipative effects in the beam-beam interaction of intersecting storage rings.** Ford, J.; Vivaldi, F. (Georgia Inst. of Tech., Atlanta (USA). Research Inst.). 1982. Contract AS05-81ER40003. 18p. NTIS, PC A02/MF A01. Order Number DE82020013.

This proposal seeks continuing support for an ongoing research investigation of various dynamical instabilities which arise in high energy intersecting storage rings due to the beam-beam interaction. Although the dissipative effect of radiation in beam-beam machines is anticipated to be a dominant feature affecting stability in the dynamics of colliding beams of heavy particles, almost nothing is known regarding the stability problem in many-dimensional dissipative systems. The work proposed here will extend the earlier computations on weak instabilities in many-dimensional beam-beam models to include the effect of dissipation. The object of this research is to obtain conditions for global beam stability over long time scales as a function of the machine parameters.

57861 **(INFN/TC—81/2) Proton beam pulse system in the Milan cyclotron.** Aghion, F.; Pagani, C.; Varisco, G. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 23 Feb 1981. 12p. (In Italian). Dep. NTIS (US Sales Only), MF A01. Order Number DE82903012.

Portions of document are illegible.

A description is given of a pulse system designed for the Milan cyclotron which is capable of extending by several hundreds of nanoseconds the period of the proton beam's temporal microstructure in order to measure the average life of the excited nuclear states. Diagrams of the pulse system, angular position of bursts, circuitry of the pulse system, and outline of the measuring system are presented. 7 references, 5 figures.

57862 **(INFN/TC—81/4) Microprocessing system for measuring proton beam emittance at the AVF Milan cyclotron.** Aghion, F.; De Martinis, C. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 27 Feb 1981. 13p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82903013.

Portions of document are illegible.

A description is given of an automatic system for measuring the emittance of a beam of particles, based on the method of two cleft movements from stepper motors. The system's control and data acquisition are governed by the INTEL SBC 80/10 microcalculator. The system described is capable of scanning beams up to a diameter of 80 mm with a resolution of 1 mm. A period of 90 seconds is required to detect an emittance figure and represent it on a video screen together with a profile of the beam. 5 references, 10 figures.

57863 **360/degree/ digital phase detector with 100-kHz bandwidth.** Reid, D.W.; Riggin, D.; Fazio, M.V.; Biddle, R.S.; Patton, R.D.; Jackson, H.A. (Los Alamos Natl Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2158-2159(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The general availability of digital circuit components with propagation delay times of a few nanoseconds makes a digital phase detector with good bandwidth feasible. Such a circuit has a distinct advantage over its analog counterpart because of its linearity over a wide range of phase shift. A description is given of a phase detector that is being built at Los Alamos National Laboratory for the Fusion Materials Irradiation Test (FMIT) project. The specifications are 100-kHz bandwidth, linearity of /plus or minus/1/degree/ over /plus or minus/180/degree/ of phase shift, and 0.66/degree/ resolution. To date, the circuit has achieved the bandwidth and resolution. The linearity is approximately /plus or minus/3/degree/ over /plus or minus/180/degree/ phase shift. 3 refs.

57864 **Measuring beam emittance for high-energy H/sup -/ accelerators.** Kramer, S.L.; Moffett, D.R. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2174-2176(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A novel technique is presented for measuring the six-dimensional beam emittance for high-energy H/sup -/ accelerators in real time. This technique uses the single charge exchange cross section from thin and narrow foils (intercepting 1-3% of the beam) as a line source for measuring the divergence and momentum spectra for operating H/sup -/ accelerator beams. By scanning the foil across the beam, X, /THETA/, and p beam density spectra and emittance can be determined. The introduction of a second foil provides the Y-/ phi/ emittance. 2 refs.

57865 **Very low intensity storage-ring profile monitor.** Hardek, T.; Kells, W.; Lai, H. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2219-2221(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Fermilab Colliding Beams Group has now accomplished several cooling experiments (electron and stochastic methods) on proton beams in the "electron cooling" synchrotron ring built for this purpose. A key to analyzing the performance of any test cooling system is a complete set of beam diagnostics to measure the beam emittances in all three planes. For longitudinal emittance the authors use Schottky scans (although very low intensities make this difficult, necessitating a departure from the conventional method by bunching the beams). A description is given of the MCP telescope and readout which evolved independently as a complete monitor system using residual gas in lieu of Mg vapor. To date all transverse measurements of coasting beam profiles have been obtained in this mode. 2 refs.

57866 **Longitudinal beam signal processing for the Fermilab beam quality monitor.** Higgins, E.F. Jr.; Moore, C. (Los Alamos Sci Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2240-2242(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A general overview of a new beam monitoring system is presented along with a detailed description of two of the signal processing units used for measuring longitudinal beam properties. 3 refs.

57867 **Fermilab energy doubler beam position detector.** Shafer, R.E.; Webber, R.C.; Nicol, T.H. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2290-2292(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A description is given of the design and performance of the beam position detector being installed in the Fermilab superconducting Energy Doubler accelerator. The detector is a stripline pickup designed to operate at 4 degrees Kelvin and with beam intensities ranging from 10/sup 8/ to 10/sup 11/ protons per rf bucket at 53 MHz. The detector design, signal amplitude, positional sensitivity, directivity, and longitudinal impedance are presented. 4 refs.

57868 **Operation of the PEP transverse beam feedback.** Olson, C.W.; Paterson, J.M.; Pellegrin, J.L.; Rees, J.R. (Stanford Univ, Calif). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2296-2298(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The PEP Storage Ring has been equipped with a wide band beam feedback system capable of damping the vertical and horizontal motion of six bunches. The oscillation detection is done at a symmetry point on the Storage Ring and feedback is applied at the same location one orbital period later. The signal is synchronously gated and the system appears as twelve independent feedback loops, operating on the two coordinates of each of the six bunches. Two beam deflection electrodes are driven each by a low-Q push-pull amplifier which is tuned at the 72nd harmonic of the revolution frequency and suppressed-carrier modulation is generated by a sequence of the detected bunch oscillations. 6 refs.

57869 **Rf beam position measurement module for the Fermilab energy doubler.** Jachim, S.P.; Webber, R.C.; Shafer, R.E. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2323-2325(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A description is given of the design, realization and performance of the rf Beam Position Measurement Module designed for the Fermilab Energy Doubler. This module measures beam off-axis position and intensity over a 60db dynamic range. For 20 or more contiguous 53MHz beam bunches, the unit will derive a position signal for 10/sup 8/ to 10/sup 11/ protons per bucket with a position accuracy of /plus or minus/0.5 mm. Also, the unit will measure the position of 10/sup 10/ or more protons in a single isolated rf bunch. A beam intensity signal is also generated for triggering purposes. Since 220 of these modules are to be built, cost and performance were optimized. The entire unit is housed in a 1-wide NIM module. 4 refs.

57870 **60 MHZ 6 bit digital to analog converters for the super beam damper of the Fermilab main accelerator.** Pasquinelli, R.J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2326-2327(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

These high speed digital to analog converters were designed and built for use in the super beam damper of the Fermilab main accelerator. They are replacements for an earlier less stable version. With complementary digital inputs, the converters provide complementary outputs of a digitally delayed beam position analog signal. Both D/A's are capable of converting a six bit digital word to / plus or minus/2.5 volts into a 50 /OMEGA/ load with dc response, typical rise and fall times of 5 nanoseconds, and long term stability. Conversion speeds of 60 MHz are easily obtained. 4 refs.

57871 **Betatron tune measurement at the Argonne rapid cycling synchrotron.** Rauchas, A.V.; Brumwell, F.R.; Cho, Y.; Czyz, W.S.; Gunderson, G.R.; Knott, M.J.; Suddeth, D.E.; Volk, G.J. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2331-2333(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Preliminary tests of the new system have been completed using the extraction kicker as a "pinger" magnet. Data has been gathered, digitized, and the FFT calculated. The results are within expectations. The new system expands the tune measurement capabilities tremendously. The computer allows for data processing which improves signal-to-noise ratio and further increases resolution. The system will also lend itself to study beam motion other than betatron. 8 refs.

57872 **Beam position measurement system at the Argonne rapid cycling synchrotron.** Rauchas, A.V.; Brumwell, F.R.; Cho, Y.; Czyz, W.S. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2338-2340(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The position measurement system for the Rapid Cycling Synchrotron (RCS) was originally designed with a four plate, combined function, capacitive pickup pi electrode situated in each of the six short straight sections. During subsequent operation, it was discovered that these electrodes were limiting the aperture and, therefore, were being activated by the circulating proton beam. In addition, the activation made it difficult to maintain the active electronic components in the RCS tunnel. The new position measurement system has been designed to eliminate these problems. The electrode's horizontal and vertical dimensions have been increased and the plates reorientated for simpler, separate function signal processing. A passive impedance matching network has replaced the active cathode follower, eliminating maintenance requirements in the accelerator tunnel. 4 refs.

57873 Large dynamic range beam profile measurement in a high background environment. Merz, W.; Dixon, R.; Harrison, M.; McCarthy, J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2372-2374(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Beam profile measurements using a scanning target and loss monitor in the Fermilab Main Ring extraction channel have long proved their usefulness as a diagnostic method in analyzing extraction problems. To extend these measurements to a sensitivity greater than in the present system a different technique has been employed. A simple three element particle telescope viewing the scanning target allows a sensitive measurement of the tail on the edges of the beam profiles as well as the relative particle densities of the extracted beam and the circulating beam in the Main Ring. Both these regions are of significant interest in understanding extraction losses. 5 refs.

57874 Electron cooling experiments at Fermilab. Forster, R.; Hardek, T.; Johnson, D.E.; Kells, W.; Kerner, V.; Lai, H.; Lennox, A.J.; Mills, F.; Miyahara, Y.; Oleksiuk, L.; Peters, R.; Rhoades, T.; Young, D.; McIntyre, P.M. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2386-2388(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A 115 Mev proton beam has been successfully cooled in the Electron Cooling Ring at Fermilab. Initial experiments have measured the longitudinal drag force, transverse damping rate, and equilibrium beam size. The proton beam was cooled by a factor of aproximately 50 in momentum spread in 5 sec, and by a factor of 3 in transverse size in 15 sec. Long term losses were consistent with single scattering from residual gas, with lifetime approximately 1000 sec. Using the measured electron beam temperature T/sub e/?0.8(2) ev, the observed cooling agrees well with expectations from cooling theory. 13 refs.

57875 Approximate physical treatment of the beam-beam effects. Teng, L.C. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2402-2404(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

When the beam-beam force is approximated as a periodic / delta/-function non-linear potential kicks, it is expected to excite a continuum (density of rational numbers) of resonances. The totality of resonance within a narrow "width" of the betatron oscillation tune contribute to a diffusion-like amplitude growth as if the kicks are random. A semi-quantitative formulation is derived and applied to electron colliding beams. 6 refs.

57876 Collective longitudinal motion in intense ion beams. Neuffer, D. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2434-2436(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Inertial Confinement Fusion (ICF) using high energy heavy ion beams requires tight focussing of the igniting ion beams in longitudinal, as well as transverse, space at the pellet target. This sets significant requirements for stability in longitudinal motion. It has been previously noted that this motion can contain significant resistive wall instability. Results of numerical simulations of this instability in perturbed bunched beams are presented and analyzed. It is found that reflection of perturbations off bunch ends is distorted and delayed by space charge forces and that "soliton" waves can appear after reflection. 5 refs.

57877 Improvements to PARMILA. Sacks, R.A.; Colton, E.P. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2443-2445(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

PARMILA is an internationally accepted standard for Monte Carlo simulation of linac and transport line performance. A discussion is presented of several modifications and improvements to this code. A generalized magnet routine allows the simulation of electrostatic and magnetic quadrupoles, solenoids, sextupoles, and octupoles. Optional inclusion of linear fringe fields and/or geometric aberrations is provided for in the quadrupole transformation. The dipole routine has been replaced with a more accurate algorithm. A number of added convenience features - interactive disk storage and retrieval of particle coordinates, individual particle input and observations, an interactively callable test for particle longitudinal stability, and an automated quadrupole tuning procedure - all add to the code's versatility, convenience, and strength as a design tool. 7 refs.

57878 ANL stochastic cooling experiments using the FNAL 200-MeV cooling ring. Hogrefe, R.L.; Kellogg, K.D.; Konecny, R.S.; Kramer, S.L.; Simpson, J.D.; Suddeth, D.E.; Hardek, T.W. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2455-2458(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Studies of stochastic momentum cooling are being conducted on the FNAL 200-Mev Storage Ring. The specific goal of the activity is to establish confidence in the theory and simulation methods used to describe the cooling process, and to develop techniques and devices suitable for use in the antiproton accumulation scheme now planned for construction at FNAL. A summary of the activity, including hardware design, results of experiments, comparison with theory, and implications for the antiproton accumulator are presented. 5 refs.

57879 Advanced stochastic cooling mechanisms. Kells, W. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2459-2461(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The heart of all proposed Stochastic p accumulators is a "fast" momentum precooling section, whose performance must match the cycle time of the accelerators which supply and empty it of ps and/or the cooling time of a companion stacking section. Here some inherent design limitations of the fast cooling section and some "ways out", are discussed. 7 refs.

57880 Design of a slot type pick-up and kicker for stochastic cooling of a coasting beam. Lai, H.H. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2483-2485(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A novel analytical approach to a slot type pickup and kicker is presented. Expressions of the coupling field from the particle beam as well as other parameters are substantially different from that obtained by Faltin. This result shows that the design is competitive with other kinds of pickup or kickers. 8 refs.

57881 Measurement and compensation of coherent Laslett tune shifts in the Fermilab main ring. Gerig, R.; Moore, C.; Pruss, S. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2486-2487(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The coherent Laslett tune shifts are studied by measuring the dependence on circulating intensity of the coherent betatron oscillation frequency at 8 GeV. The power supply control was modified to adjust the quadrupole currents so as to cancel beam induced tune changes. The article reports on running experience with this modification as well as on the data, its acquisition and reconciliation with the Laslett formulas. 3 refs.

57882 **Measurement of incoherent Laslett tune shifts in the Fermilab main ring.** Gerig, R.; Moore, C.; Pruss, S. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2488-2490(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The incoherent radial and vertical tune shifts have been measured in the Fermilab Main Ring via the resonance scan technique, and the results are compared to the Laslett predictions. 10 refs.

57883 **Comments on stable motions in nonlinear coupled resonances.** Ohnuma, S. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2491-2493(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

It is shown that, of all nonlinear coupled resonances of the form m /nu/sub //1 +n/nu/sub //2=k where m, n and k are positive integers and m+n/greater than equivalent to/3, those with m or n=1 exhibit a different property compared to others in their stable regions of phase space. The difference explains the paradoxical result obtained by P.A. Sturrock and G. Guignard that there are points of arbitrarily small amplitudes which lie outside the stable region. 4 refs.

57884 **"Arnold Diffusion" and diffusion enhancement by the beam-beam interaction.** Neuffer, D.; Riddiford, A.; Ruggiero, A.G. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2494-2496(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Results and analyses of computer simulations of the beam-beam interaction in the "Tevatron" pp collider are presented. Long-time simulations of this nonlinear two-dimensional (2-D) interaction are undertaken in a search for beam blow-up due to "Arnold Diffusion". No large blow-up is seen in simulation of 20 minutes Tevatron time (60 million turns). In separate investigations it is found that the non-linear interactions can enhance diffusion from external sources, if a low order non-linear resonance be within the "tune spread". A model to describe this enhancement is presented. 6 refs.

57885 **Non-linear and dispersive effects in the propagation and growth of longitudinal waves on a coasting beam.** Bisognano, J.; Haber, I.; Smith, L.; Sternlieb, A. (Univ of Calif, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2513-2515(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The use of an intense beam of heavy ions to ignite a thermonuclear pellet at a distance from the final lens system requires a long thin beam with a very small longitudinal velocity spread. For perturbations long compared with the beam diameter, the longitudinal electric field due to the beam space charge can be approximated by the first derivative of the line charge density. This system of equations exhibits steepening of a finite amplitude wave. When other effects are included, such as the dispersion which occurs as the perturbation wavelength approaches the beam pipe diameter, a variation in density along the beam, or the exponential growth due to wall resistivity, the wave dynamics increase in complexity. 7 refs.

57886 **First results of the University of Maryland electron beam transport experiment.** Namkung, W.; Loschialpo, P.; Reiser, M.; Suter, J.; Lawson, J.D. (Univ of Md, College Park). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2519-2521(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A study is made of emittance growth in periodically focused intense beams. For initial studies, the electron gun consists of a 1-cm diam., dispenser-type cathode and an anode covered with a wire mesh. To avoid neutralization, 5 /mu/s, 60 Hz pulses are used and the current is 230 mA at 5 kV. By varying the voltage from 10 kV to 500 volts the space charge depression, /omega/sub //omega/sub //o, of the particle oscillation frequencies in the focusing channel can be changed from approximately 0.04 to approximately 0.2. Further increase of /omega/sub //omega/sub //o should be possible with modified guns and the use of emittance control grids. Four prototype solenoids have been built, and the results of experiments with the first two are presented. 8 refs.

57887 **Charged particle beam transport using Lie algebraic methods.** Douglas, D.R.; Dragt, A.J. (Univ of Md, College Park). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2522-2524(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Methods have recently been developed enabling one to describe charged particle beam transport in terms of a Lie algebraic representation. The authors show how this formulation may be applied to the problem of computing transfer maps (including aberrations) for the beam-line elements common in accelerator physics. In addition, explicit calculations are carried out for a variety of common elements including drift sections, static magnetic dipole, quadrupole, and sextupole lengths, and dynamic sections such as bunchers. The resultant mappings are displayed, and provide a succinct basis for efficient numerical computation of charged particle beam behavior during transport. 8 refs.

57888 **Multiturn injection.** Fenster, S.; Takeda, H.; Bart, G. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2574-2576(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Several schemes are considered for transverse multiturn injection into storage rings. Careful attention is paid to geometry and timing of the emittance and acceptance ellipses, while the septum is taken as a line in phase space. The relative shape of input emittance to acceptance is varied, as well as the tune (integer + 1/n) to obtain, before space charge, zero particle loss and minimum dilution D?/epsilon/sub //A/N/sup //epsilon/sub //i, where N=number of injected turns, /epsilon/sub //A is the machine acceptance, and /epsilon/sub //i is the input emittance. Displacement of the IEO by a 4 kick bumper is idealized. 2 refs.

57889 **Synchrotron improvements with shed waveform.** Fenster, S.; Dann, T.; Moretti, A. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2577-2579(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

It is proposed to use a trigonometric series approximation to a new "shed-like" waveform to replace the usual pure sine wave (fundamental). The shed waveform divides the interval (0.2/pi/) into two parts with a crossing in between. The right portion contains the particles and is linear, while the left portion is merely an "area dump." A fit to a shed with three properly phased sine waves is demonstrated to give almost as good results as the original. In this application a fundamental frequency range 12.5 to 50.0 MHz is required. 3 refs.

57890 **Longitudinal stability of a coasting beam in a corrugated vacuum chamber.** Warnock, R.L.; Bart, G.R.; Fenster, S. (Univ of Calif, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2580-2582(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Widenings of a vacuum chamber may function as resonant cavities, which can promote longitudinal instabilities. A reexamination has been made of the stability question in such a situation, following earlier work of E. Keil and B. Zotter. The authors solve the full linearized Vlasov-Maxwell equations for a model vacuum chamber, using an improved computational method which is efficient for virtually any choice of geometrical parameters. A method is presented to compute the growth time /tau/, and find an explicit formula for /tau/ as an oscillating function of the mean revolution frequency /OMEGA/, with sharp minima at points where the real part of a cavity resonance frequency is equal to an harmonic of / OMEGA/ (plus a small shift). 2 refs.

57891 **Electron cooling for the Fermilab antiproton source.** Kells, W.; Krienen, F.; Mills, F.; Oleksiuk, L.; Peoples, J.; McIntyre, P.M. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2583-2584(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Electron cooling will be used to cool and accumulate antiprotons in the Fermilab p-bar source. Successive p-bar production cycles will be injected into the cooling ring with offset momentum, and coalesced into the stack using longitudinal electron cooling. The stacking performance of electron cooling is evaluated. The main features of the electron beam design are described. 2 refs.

57892 **Observations and cure of head-tail effect in the Argonne rapid-cycling synchrotron.** Cho, Y.; Rauchas, A.V. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2585-2586(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Radial head-tail effects have been observed in the 500-Mev Rapid Cycling Synchrotron (RCS). The threshold intensity of accelerated beam to induce the instability was 4*10/sup 11/ protons/ pulse, and the mode numbers observed were m?1 and m?2. Detailed study showed that the radial chromaticity of the lattice at this particular time in the acceleration cycle was positive. This is consistent with theoretical predictions for a machine operating below the transition /gamma/. In order to prevent the onset of this instability, a set of programmable sextupole magnets has been introduced that can be programmed to vary the chromaticity at any point during the acceleration period. With these sextupoles, the machine intensity has passed 2*10/sup 12/ protons/pulse. 3 refs.

57893 **Higher-order terms in a perturbation expansion for the impedance of a corrugated wave guide.** Krinsky, S.; Gluckstern, R.L. (Brookhaven Natl Lab, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2621-2623(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

For a square-wave (SW) wall distortion, there are divergent coefficients in the perturbation expansion. Thus a special treatment is required in this case, and present a calculation of the required in this case, and the authors present a calculation of the resonant behavior for small /epsilon/, using an approach which does not assume an expansion in powers of /epsilon/. The resulting expression for the resonant impedance involves functions singular at /epsilon/?0; however, to leading order in /epsilon/, the loss-factors and resonant frequencies are in agreement with the perturbation theory previously given. 7 refs.

57894 **Exact numerical calculation of chromaticity in small rings.** Dragt, A.J. (Univ of Md, College Park). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2627-2629(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A Newton's search method is presented which efficiently finds closed orbits in a ring whose lattice contains both linear elements, such as drifts and quadrupoles, and nonlinear elements such as dipoles with a small radius of curvature, sextupoles, etc. The method simultaneously determines the tune of the closed orbit. By observing how the location of the closed orbit depends on the total momentum, the /eta/ and /eta/sub p/rime/ functions are determined exactly (including nonlinear terms in /delta/). By observing how the tunes of the closed orbit depend on the total momentum, the chromaticities are determined exactly. 2 refs.

57895 **Buncher system parameter optimization.** Wadlinger, E.A. (Los Alamos Natl Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2630-2632(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A least-squares algorithm is presented to calculate the rf amplitudes and cavity spacings for a series of buncher cavities each resonating at a frequency that is a multiple of a fundamental frequency of interest. The longitudinal phase-space distribution, obtained by particle tracing through the bunching system, is compared to a desired distribution function of energy and phase. The buncher cavity parameters are adjusted to minimize the difference between these two distributions. Examples are given for zero space charge. 1 ref.

57896 **Gyrotrons: using relativistic electronics to produce high power, high efficiency, millimeter-wave sources.** Granatstein, V.L.; Read, M.E.; Barnett, L.R. (US Nav Res Lab, Washington, DC). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2733-2736(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Recent research on gyrotrons is reviewed. It is seen that the gyrotron oscillator is already highly developed. It has produced power at record levels, and seems destined to become a widely used device. 50 refs.

57897 **Pulsed high current optics for antiproton production at 5.4 GeV/c.** MacLachlan, J.A.; Nicholls, G.; Nicholls, J.; Silvestrov, G.; Vsevolozhskaya, T. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2785-2790(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

To minimize the antiproton collection time for proton-antiproton storage ring, the phase space density of antiprotons must be maximized within the acceptance of the antiproton cooler/accumulator. This is achieved by optimization of target geometry, target material, proton beam focusing, and antiproton collection optics. The target-station design is described for the Fermilab antiproton source. The principal difficulties arise from the need for a very intense small proton beam on the target and for a collection device with very strong focusing to handle a wide range of angles and momenta for the antiprotons diverging from the target. Special high gradient focusing devices have been developed to meet these needs. 9 refs.

57898 **Isochronous beam recirculation magnet system.** Flanz, J.B.; Kowalski, S.; Sargent, C.P. (MIT, Cambridge, Mass). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2847-2849(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The most important property of the transport system is that it be a good achromat, since operability requirements and beam loading transients usually require at least a few percent energy bandwidth over which the beam will successfully traverse the accelerator during recirculation. The system must also be nearly isochronous, with linear phase-energy correlation corresponding to not more than a fraction of an rf wavelength over a few percent bandwidth and with a small second-order phase-energy correlation coefficient. Such a system to be described has been designed and is currently under construction for the purpose of recirculating the beam of the 400 Mev Bates Linear Electron Accelerator.

57899 Modular transport design for final antiproton source to precooler. Colton, E.P. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2870-2872(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

An efficient beam collector and transport design is presented which transfers and matches a 4.5 Gev antiproton beam with momentum spread of /plus or minus/2% into the precooler admittance of 5.0/pi/ mm-mr. The limits of the transport are a solid angle acceptance of 5.0 msr and momentum pass band of /plus or minus/ 5%. A short focal length pulsed lithium lens serves as the collector. The following beam transport line is composed of: (1) vertical translation section; (2) horizontal translation section; (3) matcher; and (4) injector. Monte-Carlo techniques are utilized to evaluate effects of aberrations and multiple scattering upon the computed particle yields. Estimates are presented of the pion and muon fluxes injected into the precooler. 9 refs.

57900 Computation of intrabeam charge exchange rate. Sacks, R.A.; Arnold, R.C. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3178-3180(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Argonne National Laboratory's planned Accelerator Development Facility (ADF) for heavy-ion fusion will test and demonstrate virtually all of the beam manipulations thought to be necessary for a heavy-ion inertial confinement fusion driver. The relatively simple upgrade of adding synchrotron acceleration capability to the storage ring would also allow important energy deposition and materials experiments. The feasibility of this upgrade depends critically on the beam loss rate from charge exchange scattering. A computer program has been written for the purpose of obtaining a better estimate for this lifetime. The code assumes a K-V transverse distribution folded into a Neuffer longitudinal distribution. 5 refs.

57901 Xe/sup +n/-Xe/sup +n/ charge exchange experiment using a split-beam and beam intersection technique. Mazarakis, M.G.; Berry, G.H.; Colton, E.P. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3184-3186(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A design is described for colliding beam charge exchange experiments using the Xe beam that exits from the 1.5 MV Dynamitron of the Argonne National Laboratory Heavy Ion Fusion Facility. These experiments can be performed at any Xe beam energy as it becomes available, from 1.5 MeV to 10 MeV, and at any charge state from Xe/sup +1/ to Xe/sup +8/. 5 refs.

57902 Review of the Fermilab main ring accelerator study program as directed to the pp program. Griffin, J.E.; MacLachlan, J.A.; Bridges, J.F. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2040-2042(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Recently the colliding beam goals at Fermilab have been redirected toward 2 TeV c.m. pp physics to be done in the Tevatron. The booster-main ring complex will be the proton injector and the source of protons for anti-proton production. Consequently, the emphasis of recent studies in the main ring has been directed at those problems which arise from the beam manipulation necessary for the pp scenario. These studies are divided into three categories: 1) true storage studies directed toward revealing problems and techniques likely to apply to storage in the Tevatron, 2) beam manipulations necessary for the production of anti-protons, and 3) beam manipulations necessary for producing single proton bunches containing 10/sup 11/ protons each. 16 refs.

57903 FMIT experimental drift tube. Fox, W.E.; Schamaun, R.G. (Los Alamos Natl Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2761-2763(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

An experimental drift tube (EDT) is being developed for use in the prototype Fusion Materials Irradiation Test (FMIT) Facility. The EDT is being used as a developmental test bed for evaluation of drift-tube design and fabrication. Standard features, typical of the FMIT drift tubes, such as copper-plated stainless-steel construction, channelized-flow face cooling, beam steering coils, water-cooled quadrupole magnets, and water-cooled bore tubes, will be incorporated into the EDT.

57904 Energy saver prototype accelerating resonator. Kerns, Q.; May, M.; Miller, H.W.; Reid, J.; Turkot, F.; Webber, R.; Wildman, D. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2782-2784(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A fixed frequency rf accelerating resonator has been built and tested for the Fermilab Energy Saver. The design parameters and prototype resonator test results are given. The resonator features a high permeability nickel alloy resistor which damps unwanted modes and corona rolls designed with the aid of the computer code SUPERFISH. In bench measurements, the prototype resonator has achieved peak accelerating voltages of 500 kV for a 1% duty cycle and cw operation at 360 kV. 4 refs.

57905 Investigation of the disc-and-washer structure. Mavrogenes, G.; Gallagher, W.J. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2853-2855(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

For the purpose of estimating the difficulties to be encountered in fabricating this structure and determining the achievable microwave properties an experimental study was undertaken. In every case the studies were for /beta/?1 only; for an electron linac application only this phase velocity is of interest. In this study the authors were guided by S.O. Schriber's discovery that maximum shunt impedance occurs when the disc thickness is about half the periodic length, that is, much thicker than the original RII model. Obviously the ID of the disc was adjusted for resonance when the OD of the washer was chosen. The first part of the study was an examination of S-band structures, because of fabrication costs. Three structures were fabricated and tested at 2450 mcs. Because of the necessity of obtaining a value of Q, in the L-band study aluminum models were investigated and the final model (best structure) was dip-brazed and copper plated. 6 refs.

57906 Shaped excitation current for synchrotron magnets. Foss, M.; Praeg, W. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2856-2858(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A 500 MeV synchrotron at Argonne National Laboratory (ANL) operates at 30 Hz with its beam spill locked to neutron choppers with a precision of /plus or minus/0.5 /mu/s. The average beam will be increased by running the magnets at 45 Hz. Three 45 Hz circuits are discussed which differ greatly in overall cost and complexity. The first is a conventional 45 Hz sine wave circuit. The reduction in time for beam acceleration results in a costly increase in peak rf power. This problem is avoided in the other two circuits by making the field rise slowly and fall rapidly. The second circuit discussed is resonant at 45 Hz and 90 Hz. Exciting this circuit with a mixture of dc, 45 Hz, and 90 Hz can produce a magnetic field with the same maximum db/dt as the present 30 Hz field. 1 ref.

57907 **Disk and washer structure for an electron storage ring.** Takata, K.; Inagaki, S.; Nakanishi, H.; Kitagawa, K.; Ishimaru, H.; Yamazaki, Y.; Grand, P. (KEK, Ibaraki, Jpn). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2873-2875(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The result is given of test cavity measurements of a 500 MHz disk and washer structure which will be used for the TRISTAN electron storage ring, where the shunt impedance is required to be higher than 35 M/OMEGA/sub m/. While the calculated shunt impedance is 44.8 M/OMEGA/sub m/, the measurement indicates that 40.0 M/OMEGA/sub m/ is attainable with a single radial stem for the washer support and 35.8 M/OMEGA/sub m/ with a 2-longitudinal-stem support. 4 refs.

57908 **End magnet design for the NBS-LASL cw Microtron.** Debenham, P.H. (NBS, Washington, DC). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2885-2887(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A novel and economic magnet design has been developed which has a calculated field uniformity of better than two parts in 10/sup 4/. The design incorporates a Purcell filter into a half picture frame magnet and provides a 25% reduction in weight from an equivalent C-magnet. 10 refs.

57909 **Preparation and study of bunches containing 10/ sup 11/ protons in the Fermilab main ring.** Griffin, J.E.; MacLachlan, J.A.; Bridges, J.F. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2037-2039(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A scenario for combining four adjacent bunches in the Fermilab main ring into a single bunch containing 10/sup 11/ protons is described. This is to be done using a 7th sub-harmonic rf cavity. First experimental results of the procedure are shown. 4 refs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 57866, 57869, 57870, 57871, 57893, 57898

57910 **(AD-A—111451/1) Heavy ion fragmentation at intermediate energy. Memorandum report.** Kidd, J.; Seeman, N.; Woods, G. (Naval Research Lab., Washington, DC (USA)). 1 Mar 1982. 26p. (NRL-MR—4733). NTIS, PC A03/MF A01.

The N.R.L. Heavy Ion Experiment, which was run at the Lawrence Berkeley Laboratory Bevatron Accelerator, measured the single-particle inclusive productions cross sections and momentum distributions for carbon ions at 250 Me V/u incident on CU, C, CH2 (and hydrogen) targets. The discussion of this experiment will include: (1) the detector design, (2) the beam monitoring system and fast logic, (3) the running system software, and (4) the analysis and preliminary results. The mass resolution achieved was Delta approx 0.15 and the spatial resolution with the drift chamber was approx 0.5mm. A separate report will discuss the final results and their implications.

57911 **(AD-A—111506/2) Electromagnetic characterization of a Marx pulse generator. Final report.** Giri, D.V.; Graham, F.R. (Mission Research Corp., Albuquerque, NM (USA)). Jul 1981. 129p. NTIS, PC A07/MF A01.

This report reviews the electrical characteristics of the Marx pulser installed in ATLAS I (TRESTLE) facility. Various individual components of the pulser, e.g., monocone switch, central Marx column and peaker arms are studied for their electromagnetic properties. The resulting design curves and tables for peaker arm optimization are presented along with calculated pulser output waveforms for step inputs. Also included is a list of recommendations for future work.

57912 **(AD-A—111514/6) Improved design AURORA modification program (IDAMP). Special report.** Graybill, S.E.; Huttlin, G.A.; Kerris, K.G.; Stewart, A.G.; Whittaker, D.A. (Harry Diamond Labs., Washington, DC (USA)). Dec 1981. 30p. NTIS, PC A03/MF A01.

The AURORA High-Intensity Flash X-Ray Facility could be modified to provide a high-energy, medium (2 to 10 omega) impedance, multiterawatt pulse power source. This Improved Design AURORA Modification Program (IDAMP) could be achieved with only modest restructuring of the existing AMP water-insulated pulser. Transformer oil, rather than deionized water, would be the insulating medium. A power output of >5 TW in a pulse of <5 MV amplitude and approx. = 140 ns FWHM is feasible in either positive or negative polarity. This power source could be applied to high-intensity electron, ion, and microwave beams.

57913 **(BNL—31570) Wiggler, undulator, and free-electron laser-radiation sources development at the National Synchrotron Light Source.** Hsieh, H.; Krinsky, S.; Luccio, A.; Pellegrini, C.; van Steenbergen, A. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 25p. (CONF-820839—1). NTIS, PC A02/MF A01. Order Number DE82018059.

From International conference on X-ray and VUV synchrotron radiation instrumentation; Hamburg, F.R. Germany (9 Aug 1982).

Portions of document are illegible.

An overview is presented of the special radiation sources development at the NSLS for incorporation in a 2.5 GeV X-ray storage ring and a 700 MeV vuv storage ring. This includes a superconducting high field multipole wiggler, lambda/sub c/ = 0.5A; a permanent magnet wiggler, lambda/sub c/ = 2.0A; a maximum photon energy undulator (5 to 7 keV); an undulator for a soft X-ray line or continuum spectrum and a free electron laser source tunable in the 2500 to 4500A region. Source characteristics and status of development are given. In addition, the incorporation of a backscattered Compton photon source is being studied and relevant parameters are presented.

57914 **(JAERI-M—9283) Expansion of the data acquisition system for the 20 MV tandem accelerator.** Tomita, Y. (Japan Atomic Energy Research Inst., Tokyo). Feb 1981. 91p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82702212.

This report describes an expansion of the program of the data acquisition system for the 20 MV tandem accelerator. By the present expansion it became possible to change the accuisition mode or to use non-standard CAMAC modules with partial modification of the program according to well defined prescriptions. The modification can be made by writing microprograms for the MBD or appending subroutines for the reduced spectra in the LIST mode data acquisition. The new program can handle up to 32 ADC's in the standard LIST mode data acquisition. The present expansion aimed to increase the flexibility in data acquisition. It can also be applied to control experimental devices.

57915 **(Juel-Spez—120) Theoretical target-physics studies for the SNQ spallation neutron source.** Armstrong, T.W.; Cloth, P.; Filges, D.; Neef, R.D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jul 1981. 133p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82903741.

This report presents the results of calculations that have been made for the target station of a spallation neutron source. This work has been performed as part of a German feasibility study of obtaining intense neutron beams for solid state physics research by using high-energy proton accelerators. An introductory discussion of spallation phenomenology and theoretical models and methods is given. Some preliminary work has been done on the validation of the theoretical methods used by comparison with experimental results. The main conclusion of this theoretical study is that for the parameters and the configuration considered - the design parameters of the German SNQ project - the peak and average thermal flux goals can be attained.

57916 **(PB—82-162306) Primer on theory and operation of linear accelerators in radiation therapy. Final report.** Karzmark, C.J.; Morton, R.J. (Stanford Univ., CA (USA). School of Medicine). Dec 1981. 63p. NTIS, PC A04/MF A01.

This primer is part of an educational package that also includes a series of three videotapes entitled 'Theory and Operation of Linear Accelerators in Radiation Therapy, Parts I, II, and III'. This publication provides an overview of the components of the linear accelerator and how they function and interrelate. The auxiliary systems necessary to maintain the operation of the linear accelerator are also described.

57917 **Instrumentation for the Tevatron beam dump.** Harms, E.; Hendricks, B.; Lee, G.; Williams, T. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2771-2773(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A graphite core beam dump designed to accept aborted protons from both the Main Ring and the Tevatron has been installed at Fermilab. Instrumentation was designed and constructed to monitor the integrity of the dump, the temperature at various locations about the core, and the position of the beam at the front face of the dump. These devices include calorimeters, temperature sensing devices, and an ionization chamber. Constraints were placed on the choice of materials used due to expected maximum temperatures of 400/degree/C and accumulated doses over 10 years of up to 10/sup 10/ R. Presented in this study are details of the choice of materials for and the design and construction of the desired instrumentation. 5 refs.

57918 **High intensity beam dump for the Tevatron beam abort system.** Kidd, J.; Mokhov, N.; Murphy, T.; Palmer, M.; Toohig, T.; Turkot, F.; VanGinneken, A. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2774-2776(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The beam abort system proposed for the Fermilab Tevatron Accelerator will extract the proton beam from the ring in a single turn (approximately 20/mu/s) and direct it to an external beam dump. It is the function of the beam dump to absorb the unwanted beam and limit the escaping radiation to levels that are acceptable to the surrounding populace and apparatus. A beam dump that is expected to meet these requirements has been designed and constructed. Detailed design of the dump, including considerations leading to the choice of materials, are given. 6 refs.

57919 **Snapshot digitizer system for Fermilab main accelerator.** Pasquinelli, R.J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2168-2170(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The snapshot digitizer system is becoming an important diagnostic tool for the Fermilab main accelerator. This high speed data acquisition system operates at 53 MHz. Inputs to the system are various beam processors whose analog outputs may be digitized and stored in any combination of groupings; i.e. diagnostic mode, starting on any of the 1113 bunches, digitizing 1-1113 sequential bunches, with anywhere from 1-9999 turns around the 4 mile accelerator between digitizations. The system can be gated on at any point of the machine cycle. A description is given of the hardware and timing necessary for the system to operate. Figure 1 is the system block diagram. 3 refs.

57920 **Phase lock of rapid cycling synchrotron and neutron choppers.** Praeg, W.; McGhee, D.; Volk, G. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2171-2173(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The 500 Mev synchrotron of Argonne's Intense Pulsed Neutron Source operates at 30 Hz. Its beam spill must be locked to neutron choppers with a precision of /plus or minus/0.5 /mu/s. A chopper and an accelerator have large and different inertias. This makes synchronization by phase lock to the 60 Hz power line extremely difficult. The authors have solved the phasing problem by running both the Ring Magnet Power Supply (RMPS) of the synchrotron and the chopper motors from a common oscillator that is stable to 1 ppm and by controlling five quantities of the RMPS. The quantities controlled by feedback loops are dc current, injection current, ejection current, resonant frequency, and the phase shift between the synchrotron peak field and the chopper window. 4 refs.

57921 **Beam quality measurements in Fermilab main ring.** Gerig, R.; Moore, C.; Pruss, S. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2177-2179(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Each Main Ring cycle the Fermilab Booster injects 13 batches, each containing 84 rf bunches into the Main Ring. The authors have measured bunch distributions in longitudinal width, in phase angle with respect to the Main Ring rf, and in transverse position. A system has been developed which utilizes data from all the bunches and derives numbers indicative of these distributions. The system is used to help determine the source of operational problems. It is also used in a slightly different mode to observe the behavior of any number of bunches throughout Main Ring acceleration. This paper describes the analysis and display of the data, and how the system has aided Main Ring and Booster diagnostics. 6 refs.

57922 **Tevatron control system.** Bogert, D.; Chapman, L.J.; Ducar, R.J.; Segler, S.L. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2204-2206(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Tevatron Control System is a large distributed facility controlling the 6.28km Tevatron Accelerator from more than thirty distinct control locations. The system employs CAMAC hardware as the primary control interface. Self-cycling microprocessor based systems that utilize more suitable computer bus architectures are readily accommodated. The scale and nature of the Tevatron warrants special consideration as to system throughput and snapshot data handling. Computer based facilities can be provided at the service building level to assist host computer functions and to permit local diagnostics.

57923 **Tevatron serial data repeater system.** Ducar, R.J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2301-2302(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A ten megabit per second serial data repeater system has been developed for the 6.28km Tevatron accelerator. The repeaters are positioned at each of the thirty service buildings and accommodate control and abort system communications as well as distribution of the Tevatron time and energy clocks. The repeaters are transparent to the particular protocol of the transmissions. Serial data are encoded locally as unipolar two volt signals employing the self-clocking Manchester Bi-Phase code. The repeaters modulate the local signals to low-power bursts of 50 MHz rf carrier for the 260m transmission between service buildings. The repeaters also demodulate the transmission and restructure the data for local utilization. The employment of frequency discrimination techniques yields high immunity to the characteristic noise spectrum.

57924 CAMAC serial crate controller for the Tevatron accelerator. Ducar, R.J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2303-2304(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A CAMAC serial crate controller has been developed for the Tevatron Accelerator Control System. The controller accommodates two serial ports of access, block transfer read facility, and aggregate command capability. Communications to the controller are bit serial at a 10 megabit rate and employ a specially developed protocol. The programmed serial ports allow better than 50K dataway operations per second. The Block Transfer read facility operates in the UQC model and can perform at the rate of 250K dataway operations per second. Operations at both ports and the Block Transfer function may be fully interleaved. The design provides for programmed arbitration of the two serial ports allowing either port to reserve the crate or a target slot for an uninterrupted sequence of dataway operations. 2 refs.

57925 Vacuum control subsystem for the Fermilab Tevatron. Zagel, J.R.; Chapman, L.J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2305-2307(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The CAMAC 170 module and CIA crate provide a convenient, cost effective method of interfacing any system requiring a large number of simple devices to be multiplexed into the Accelerator Control System. The system is ideal for relatively slowly changing systems where ten bit analog to digital conversions are sufficiently accurate. Together with vacuum interface CIA cards and prom-based software resident in the 170, this system is used to provide intelligent local monitoring and control for the Tevatron vacuum subsystems. Although not implemented in the vacuum interface, digital to analog converters could be included on the plug in modules as well, providing a total digital and analog multiplexing scheme. 2 refs.

57926 Microprocessor based function generator for superconducting dipole correction coils. Beechy, D.; Bogert, D.; Segler, S.; Watts, T. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2311-2313(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The design for the Fermilab Tevatron includes approximately 200 dipole correction coils which serve to counteract the dipole field errors of the main superconducting dipole magnets. The current in these correction coils is to be individually controlled by means of 200 separate microprocessor-based function generators which drive separate bipolar 50 amp power supplies. The output of each of these function generators is a correction voltage of 12-bit resolution, calculated by the microprocessor, of the form v/sub c/(i,t)?i[g(i)+f(t)], where i is the instantaneous current in the main superconducting bending dipoles and t is real time.

57927 3kG kicker magnet system for the tevatron beam abort system. Krafczyk, G.; Edwards, H.; Kerns, Q.; May, M.; Tilles, E.; Turkot, F. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2769-2770(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A report is presented on the design of the prototype kicker magnet system to be used in the abort channel of the Tevatron at Fermilab. The magnet has a peak field of 3kG, a 10-90% rise time of 1.5/mu/s, and the field is greater than 90% of peak for 21/mu/sec. The kicker magnetic energy is stored in a capacitor and resonantly discharged into the magnet inductance. When the magnet is completely charged a thyratron-ignitron combination is used to clip the recharge of the capacitor and circulate the current in the magnet. 7 refs.

57928 Four quadrant magnet power supply for superconducting and conventional accelerator applications. Yarema, R.J. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2809-2811(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Modern conventional and superconducting accelerators often require bipolar power supplies capable of operating with high precision from zero to full output. An SCR type power supply comprised of two SCR bridges and operating with circulating current does an excellent job of satisfying this difficult requirement. Power supplies of this type are often called four-quadrant or dual converter power supplies with circulating current. The basic principles and design considerations of this converter are discussed with particular emphasis on the advantages of the converter. Application of the dual converter to high precision bipolar magnet current control within the Fermilab Saver/Doubler project is presented. 4 refs.

57929 Mechanical design of Lambertson magnets for injection into the energy saver. May, M.; Edwards, H.; Harrison, M.; Jagger, J.; Isiminger, R. (Fermilab Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2842-2843(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The design concept adopted for injection Lambertson magnets for Fermilab Energy Saver is described. The features discussed are lamination stacks and vacuum system.

57930 Fermilab power monitor. Gerig, R.; Pfeffer, H. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2901-2903(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Because of the complex price structure under which Fermilab buys its electrical power from the Commonwealth Edison Power Company, the Laboratory must carefully control its energy consumption rate. The rate has to stay below strict limits which vary from day to night and weekday to weekend. At the same time it is important to run as close to these limits as possible to derive the most benefit from the pricing structure. A description is given of the microprocessor system which compares site power with programmed limits, graphically displays relations and trends, informs operators of corrective actions if needed, and trips the major power load if limit violation is imminent.

57931 1-megawatt cw rf power source for 80 MHz. Fazio, M.V.; Hoffert, W.J.; Patton, R.D.; Sutherland, R. (Los Alamos Natl Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2904-2906(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Fusion Materials Irradiation Test (FMIT) accelerator requires 13 rf amplifiers at 80 MHz, with a cw output of 600 kW each. The EIMAC 8973 (formerly the X-2170) was chosen as the amplifier tube for this application. Never before had the 8973 been operated at this power level and frequency; therefore a test program was initiated to determine its capabilities. The tube was operated Class B in the grounded-grid, grounded-screen configuration. Maximum cw output power was in excess of 1 MW, with a plate efficiency greater than 60% and a 14-db gain. Details of the test setup and the results are presented.

57932 Status of efforts to improve the transverse properties of the Fermilab booster. Owen, C.W.; Brown, B.C.; Crawford, J.; Garvey, J.; Gerzevske, H.; Lackey, J.; Meisner, K.; Rice, R. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2907-2909(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Recent changes in the injection beam line and the injection and extraction long straight sections of the Fermilab Booster have resulted in both larger apertures and simpler operation. These have facilitated further studies of the aperture limitations in the Booster. The authors summarize their studies and results and indicate present aperture limitations. Operational benefits and transmission effects are discussed. 6 refs.

57933 **Improved FNAL linac beam choppers.** Bourkland, K.; Curtis, C.; Lee, G.; Tool, G. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2994-2996(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A discussion is presented of the 750-KeV chopper experience with both proton and negative ion beams and the ability of these systems to tailor the Linac beam to the diverse requirements of its users; normal accelerator injection, neutron therapy beam, and electron cooling experiments. This flexibility plus a cleaner beam pulse, improved thyratron operation, and mechanical modularity are the results of recent improvements. Additional benefits have been increased reliability and ease of service to the 750-KeV chopper. 3 refs.

57934 **Active filter for high current dc magnets.** Cilyo, F.F.; Mills, F.E.; Miyahara, Y. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3014-3016(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Thyristor type regulated power supplies operated from 3 phase power lines are sensitive to phase unbalance, voltage fluctuations, line impedance and to other loads connected to the same line. At Fermilab, the large variety of pulsed equipment provides such perturbations in a wide frequency domain. A description is given of active filters used to stabilize magnet power supplies for a storage ring against fast fluctuations.

57935 **Magnetization characterization study for the energy saver/doubler dipoles.** McInturff, A.D.; Gross, D. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3211-3213(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

One of the challenging problems in superconducting accelerator dipoles is their dynamic behavior under ramping magnetic field produced loads. Their behavior can be observed with hysteretic measurement of the energy flow in the magnet. This technique determines changes in inductance, deflection of coils, dynamic loses, the superconducting cable's critical current vs. field and coupling curves, and iron shield saturation reproducibility. These measurements, when cross correlated with integral field, NMR and harmonic data yield a comprehensive characterization of the magnet. Data are presented for several magnets tested in the Magnet Test Facility of Fermilab. 1 ref.

57936 **Spark protected ion source control and monitoring system at 1.5 MV.** Bogaty, J.M.; Zolecki, R. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2350-2352(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Heavy Ion Fusion Program at Argonne National Laboratory utilizes a 1.5 Mv Xe ion preaccelerator. Reliable beam transport requires accurate measurements and precise control of various ion source parameters. A discussion is presented of the use of a multiplexed fiber optic data transmission system and low cost digital stepper motors for control functions. Techniques are discussed which allow TTL and CMOS semiconductor circuits to survive the destructive sparks which can occur in the 1.5 Mv preaccelerator. 5 refs.

57937 **Recent developments in polarized ion sources.** Parker, E.F. (Hanford Eng Dev Lab, Richland, Wash). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2640-2643(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

After many years and a great deal of success in developing the Lamb-shift and ground-state-type polarized ion sources the polarized ion source users are now shifting their attention to several fundamentally different approaches. These new approaches appear to have the potential of producing H/sup -/ currents that are many orders of magnitude larger than allowed by conventional sources. 25 refs.

57938 **Polarized H/sup -/ ion source development for the AGS.** Schultz, P.F.; Moffett, D.R.; Colton, E.P.; Kponou, A.; Hughes, V.W. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2675-2677(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The polarized H/sup -/ ion source that Argonne National Laboratory and Yale University are building for the AGS polarized beam facility is based on the crossed beam concept in which a polarized atomic hydrogen beam, H/sup o//sub //ARROW UP/, is ionized to H/sup -/ by a fast neutral cesium beam, Cs/sup o/. The authors describe studies which will aid in achieving a high intensity polarized H/sup -/ beam. In particular, the authors describe time-of-flight studies on the atomic beam and the effect of dissociation nozzle cooling on the velocity distribution. The cesium gun design is described. 8 refs.

57939 **Intense H/sup -/ source for the IPNS-I rapid cycling synchrotron.** Moffett, D.R.; Barner, R.L. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2678-2680(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Increases in the intensity of the Intense Pulsed Neutron Source (IPNS-I) at Argonne National Laboratory will eventually require that the present H/sup -/ ion source be replaced with a higher current source. Laboratory studies of a Penning H/sup -/ ion source for this purpose have been carried out. The source design is essentially due to Allison. The source has operated continuously for more than a week at 15 Hz with 45 mA of H/sup -/ current during the 80 /mu/s pulse. For shorter periods, it has delivered the same current at 30 Hz with 45 /mu/s pulses. At present, two technical problems prevent the source from being operational. It is not adequately reliable, and the beam emittance at 20 keV is larger than expected. 4 refs.

57940 **Beam, an improved beam extraction and acceleration modeling code.** Shubaly, M.R.; Judd, R.A.; Hamm, R.W. (AECL, Chalk River, Ont, Can). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2655-2657(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The desirable features of an ion beam extraction and acceleration modeling code are outlined, and features of the BEAM (Beam Extraction and Acceleration Modeling) code are described. Examples of typical calculations are given and plans for future development are presented. 16 refs.

57941 **Multi-stage intense ion beam electrostatic accelerator for ICF.** Guiragossian, Z.G.T.; Orthel, J.L. (TRW, Redondo Beach, Calif). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2669-2671(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The design of a multi-aperture, channel focused, multi-stage low /beta/ electrostatic accelerator is made to produce well controlled intense light ion beams as drivers of Inertial Confinement Fusion (ICF) targets. Unlike the case of diode accelerators, the Light Ion Fusion Experiment (LIFE) accelerator system contains separate-function elements to launch 3 to 10 Mev, 23 kA accelerated current, He/sup +/ beams in 400 ns pulses where 20:1 axial pulse compression would occur during the neutralized and ballistically focused transport. Each beam line would impart 50 kJ implosion energy in approximately 20 ns on 5-6 mm radius targets located 10 m downstream and a system of 40 beam lines would deliver 2 MJ. 4 refs.

57942 Antiproton collection from a production target. Krienen, F.; MacLachlan, J.A. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2711-2716(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A review is presented of several aspects of the production and the collection of antiprotons produced by high energy beams of high intensity. The goal is to optimize in cost the number of antiprotons of given momentum bite one can accumulate per unit of time. Aspects which are dealt with entail the antiproton production spectrum, proton beam emittance, multiple scattering, antiproton acceptance, and phase-space matching, including chromaticity. Several hardware alternatives are considered. 7 refs.

57943 Dependence of the emittances of the Fermilab injectors on intensity. Moore, C.; Curtis, C.; Lackey, J.; Owen, C.; Ankenbrandt, C.; Gerig, R.; Pruss, S. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3000-3001(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A report is presented on the dependence of the emittance of the Main Ring injected beam on Booster intensity. The intensity was changed in two different ways: by changing the number of turns injected into the Booster using the normal H/sup -/ charge-exchange injection and by changing the intensity of the Linac itself by varying the phase of the buncher. The measured emittance of the Linac beam was also compared, assuming adiabatic shrinkage, to the emittance of the Main Ring beam measured while injecting one turn into the Booster. 4 refs.

57944 Rapid cycling synchrotron extraction kicker magnet drive system. Suddeth, D.E.; Volk, G.J. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3017-3019(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Rapid Cycling Synchrotron (RCS) accelerator of the Intense Pulsed Neutron Source-I (IPNS-I) at Argonne National Laboratory utilizes a fast kicker magnet to provide single-turn extraction for a 500 Mev proton beam at a 30 Hz rate. The single-turn, 0.89 m long ferrite magnet is broken up into two identical cells with four individual windings. Each winding requires a 4863 A magnetizing current into a 7.0 /OMEGA/ load with a rise time of less than 100 ns and a flattop of about 140 ns. Pulse forming network (PFN) charging and switching techniques along with the components used are described. 1 ref.

57945 Study of the rf capture process in the Argonne rapid cycling synchrotron. Cho, Y.; Potts, C.W.; Rauchas, A.V.; Shin, S.A.; Takeda, H. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3040-3042(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The 500-MeV Rapid Cycling Synchrotron (RCS) guide field is energized by a dc-biased, 30 Hz sinusoidal ac power supply, and the field strength varies between 2.81-9.81 kG. During the acceleration period, the db/dt varies in a half-sine function from zero to a maximum of 670 kG/s and back to zero. Although the average db/dt during injection is not equal to zero, efficient capture has been obtained experimentally by adjustment of the rf voltage program and the injection timing. A description is given of a simulation study of the capture process in order to understand the experimental results. 2 refs.

57946 Design of a single cavity harmonic buncher for Argonne's low beta heavy ion linac. Moretti, A.; Lari, R.J.; Watson, J.M. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3043-3045(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A compact harmonic buncher cavity has been designed for Argonne's low beta Xe/sup +1/ linac. The resonant sections are nested together to save beam line space. The cavity is approximately 1.5 m in height and at its maximum 0.4 m in outside diameter. It takes up only 0.22 m of beam line space. The computer program "Superfish" and a transmission line model of the resonator were used to calculate its properties. Considering the complicated geometry, excellent agreement (within 1%) was achieved. 8 refs.

57947 Determination of transverse phase-space and momentum error from size measurements along the 50-MeV H/sup -/ RCS injection line. Cho, Y.; Crosbie, E.A.; Takeda, H. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3046-3048(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The 50-Mev H/sup -/ injection line for the RCS at Argonne National Laboratory has 16 quadrupole and eight bending magnets. Horizontal and vertical profiles can be obtained at 12 wire scanner positions. Size information from these profiles can be used to determine the three ellipses parameters in each plane required to describe the transverse phase space. Those locations that have dispersion permit the momentum error to be used as a fourth fitting parameter. The assumed accuracy of the size measurements provides an error matrix that predicts the rms errors of the fitted parameters. 3 refs.

57948 Studies of an unneutral electron cloud in the CFIA. Fisher, A.; Gilad, P.; Goldin, F.; Rostoker, N. (Univ of Calif, Irvine). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3383-3385(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

In the Collective Focusing Ion Accelerator (CFIA) scheme, a non-neutral electron cloud is trapped in a multiple mirror toroidal magnetic field. The electrons' radial electrostatic field serves to confine and focus an accelerated ion beam. The ion beam, with a density up to 10% that of the electrons', is accelerated by an induced toroidal electric field. The induced toroidal electric field, however, is not strong enough to overcome the mirror force acting on the electrons. This scheme enables the construction of a very small radius accelerator in the GeV range. As a first stage in the development of the CFIA, it is necessary to demonstrate trapping and stability of a non-neutral electron cloud over a long time (a few msec). It is also necessary to show that the electron cloud remains confined to the mirror cells when an accelerating toroidal electric field is applied. 5 refs.

57949 Infrared measurement of the temperature distribution of a repetitively pulsed electron beam extraction foil as a beam uniformity diagnostic. Buttram, M.T.; Ginn, J.W.; Phipps, G.S. (Sandia Natl Lab, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3392-3394(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A presentation is made of experiments to measure the current extracted through the foil of an electron beam diode by observing the heating of the foil. Generally anode current density is measured with a dosimeter film, often of dubious linearity, or with Faraday cups which give a current density versus time map at isolated points or with an array of calorimeters. For the present measurements a fast scanning infrared camera is used to measure the temperature rise of the foil after a pulse. The measurement takes 600/mu/s for a single line scan or 16 ms for a full raster scan. 5 refs.

57950 **Status of the Argonne heavy ion fusion low-beta linac.** Watson, J.M.; Bogaty, J.M.; Moretti, A.; Sacks, R.A.; Sesol, N.Q.; Wright, A.J. (Argonne Natl Lab, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3449-3451(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The primary goal of the experimental program in heavy ion fusion (HIF) at Argonne National Laboratory (ANL) during the next few years is to demonstrate many of the requirements of a RF linac driver for inertial fusion power plants. So far, most of the construction effort has been applied to the front end. The ANL program has developed a high intensity xenon source, a 1.5 MV preaccelerator, and the initial cavities of the low-beta linac. The design, initial tests and status of the low-beta linac are described. 8 refs.

57951 **120-GeV superbooster for Fermilab.** Huson, F.R. (Fermilab, Batavia, Ill). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2046-2048(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A new superconducting accelerator is proposed which would replace the Fermilab Main Ring as an injector for the Energy Doubler and would be a source of protons for producing antiprotons for the p-bar source. This accelerator would provide 2*10/sup 13/, 120-GeV protons every two and one-half seconds for injection into the Energy Doubler or for antiproton production. The intensity in the Energy Doubler and p-bar production rate would be increased by large factors. Magnets similar to the Energy-Doubler magnets would be used. 4 refs.

57952 **Status report on the rapid cycling synchrotron.** Potts, C.W.; Brumwell, F.R.; Cho, Y.; Rauchas, A.V.; Volk, G.J. (Argonne Natl Lab, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2104-2106(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Rapid Cycling Synchrotron (RCS), originally designed as an injection energy booster for the Zero Gradient Synchrotron (ZGS), operated under constraints imposed by ZGS operation until December 1979. Once these restraints were removed, the RCS made rapid strides toward its near term goals of 8 /mu/A of protons for Argonne National Laboratory's Intense Pulsed Neutron Source program. Reliable 30 Hz operation was achieved in the spring of 1980 with beams as high as 2*10/sup 12/ protons per pulse and weekly average intensities of over 6 /mu/A on target. These gains resulted from better injection matching, more efficient rf turn-on and dynamic chromaticity control. 8 refs.

57953 **Measurements of H/sup o/ and H/sup +/ ion yields during H/sup -/ acceleration in a 50-MeV linac.** Cho, Y.; Madsen, J.; Shin, S.A.; Stipp, V. (Argonne Natl Lab, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2888-2889(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Unlike proton linacs where the only particles that can be transported are protons, an H/sup -/ linac can produce H/sup o/ and protons by stripping off one or both electrons of H/sup -/ ions during acceleration. We have measured yields of these ions as a function of linac tank pressures. 1 ref.

57954 **Design and operation water-cooled pyrolytic graphite targets at LAMPF.** Brown, R.D.; Grisham, D.L. (Los Alamos Natl Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2940-2942(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Design considerations and actual operating experience are reported for water-cooled pyrolytic graphite targets at the Clinton P. Anderson Meson Physics Facility (LAMPF) at Los Alamos, NM. Emphasis is placed on the use of finite element computer calculations to determine target temperatures and stresses, which can then be evaluated to judge the usefulness of a particular design. Considerations is also given to the swelling of the target following irradiation, and to the measures taken to prolong target lifetime. This work is pertinent to patient treatment. 8 refs.

57955 **Intense pulsed neutron sources.** Kustom, R.L. (Argonne Natl Lab, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3115-3119(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Accelerator requirements for pulsed spallation neutron sources are stated. Brief descriptions of the Argonne IPNS-I, the Japanese KENS, Los Alamos Scientific Laboratory WNR/PSR, the Rutherford Laboratory SNS, and the West German SNQ facilities are presented. 10 refs.

57956 **Conceptual design for an accelerator system for a very high-intensity pulsed neutron source using a linear induction accelerator.** Foss, M.H. (Argonne Natl Lab, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3181-3183(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

In a synchrotron system, the protons are already bunched, and thus the pulse rate of the neutron beam is that of the repetition rate of the synchrotron. For an accumulator system, the pulse rate is determined by the extraction repetition rate of the accumulator. The author has conceptually designed a new system that uses a linear induction accelerator which can be operated for an average beam current up to a few mA with a repetition rate up to 100 Hz. The details of the design are given. 1 ref.

57957 **Development of superconducting resonators for the Argonne heavy-ion linac.** Shepard, K.W. (Argonne Natl Lab, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3248-3250(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A method is outlined for conditioning resonators which has produced a significant increase in accelerating gradient and also a design for a split-ring resonator with an optimum particle velocity of 0.16 c. Results of using a 1500 watt rf source to condition superconducting split-ring resonators are described. By repetitively pulsing for a few msec to field levels as high as an 8 MV/m effective accelerating field E/sub a/, electron loading at high field levels has been substantially reduced. The 145.5 MHz resonator is contained in the same 16 inch diameter, 14 inch length housing used for the / beta/?0.1 Argonne split-ring. In design of the split ring element, a 20% reduction in peak surface electric field has been achieved with no significant increase in surface magnetic field. 5 refs.

57958 **Quasi-optimal algorithms for the control loops of the Fermilab energy saver satellite refrigerator.** Martin, M.; Gannon, J.; Rode, C.; McCarthy, J. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3251-3253(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Cryogenic System of the Satellite Refrigerator for the Energy Saver Accelerator Ring comprises 12 interrelated closed loops and several open loops. A quasi-optimal algorithm to control the Cryogenic System, under different modes operation, is described. The constraints imposed to define these algorithms and the process followed to characterize the functional parameters are described. A report on the results obtained with the algorithms in a test facility will be presented. 6 refs.

57959 **Fermilab energy saver refrigeration system tests.** Theilacker, J.; Rode, C.; Makara, J.; Richied, D.; Leninger, M.; Ferry, R.; Mizicko, D.; Misek, J. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3257-3259(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The Energy Saver Refrigeration System is based on the concept of a central helium liquefier (5000 l/hr) providing liquid to 24 satellite refrigerators (966 W at 4.6/degree/K), which operate as amplifiers with a gain of 12. This concept was tested, cooling two 125 m long strings of superconducting magnets. The test was run using one satellite refrigerator operating as the "central liquefier", shipping liquid helium through a 250 m long transfer line to a second satellite refrigerator, which in turn cooled the magnets. In addition to testing the satellite concept, the heat loads of the magnets and transfer line were also measured. 3 refs.

57960 **Correction magnet packages for the energy saver.** Ciazynski, D.; Mantsch, P. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3275-3276(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The design of the superconducting correction coil system for the Energy Saver has been finalized and production is underway. The requirements of low current (50A) and concentric placement of multipole elements posed difficult and unique design problems. 2 refs.

57961 **Energy saver/doubler quench protection monitor system.** Flora, R.; Saarivirta, J.; Tool, G.; Voy, D. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3289-3291(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The microprocessor based system to detect quenches in the superconducting magnets is described. Tests conducted over the past two years using a string of twenty superconducting magnets have yielded results having major impact on the design of this system. A network of twenty-four 16-bit microprocessors will monitor the integrated voltage across magnet protection units every 60 Hz line period using isolated voltage to frequency converters. These measurements are compared with the inductive voltage expected. Under transient conditions, the distributed L-C nature of the magnets delays signal propagation as in a transmission line. To achieve the required sensitivity of resistive voltage detection, the inductive voltage for each magnet cell is calculated using two of the six measured dI/dt signals. 5 refs.

57962 **Multi-level computer simulation of the energy saver cooling provisions.** Barton, H.R. Jr.; Mulholland, G.T.; Nicholls, J.E. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3306-3308(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Mathematical models have been developed to describe the detailed temperature distributions within Energy Saver cryoloops as a function of static and ramp loads. The Satellite performance as a function of the Central Helium Liquefier flows, is calculated for a single equipment specification set. The performance of the system over a wide range of parameters results in clearly defined optima and detailed far-from-design predictions. The agreeement of experimental test data and the simulation prediction is explored for individual magnets, strings and the Satellite-mode refrigerator. 4 refs.

57963 **Magnetostatic design of 85kg superconducting dipoles.** Snowdon, S.C. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3309-3311(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Extension of the present Tevatron dipole to 85kg has been considered by R.R. Wilson. An accelerator utilizing such dipoles has been designed as the Pentevac since it would permit 5 TeV protons to circulate within the boundaries of the Fermilab site. This study contains results of magnetic field, force, and mechanical stress calculations for one possible Pentevac dipole. 9 refs.

57964 **Multiple element vapor cooled current leads for the Fermilab energy saver correction elements.** Nicol, T.H. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3317-3319(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The development of the Energy Saver at Fermilab requires the installation of nearly 500 correction coil packages, each containing three elements operated at a nominal 50A each. This necessitates twelve penetrations from ambient conditions to liquid helium at each quadrupole package. The design and test results of complete package containing all twelve vapor cooled conductors will be discussed in full. 1 ref.

57965 **Spool piece testing facility.** Kuchnir, M.; Walker, R.J.; Fowler, W.B.; Mantsch, P.M. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3325-3326(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

"Spool Piece" is the name given to the modular component of the Energy Saver which contains the correction magnets and several other devices required by the superconductive and cryogenic nature of this synchrotron. Approximately 230 spool pieces will be built to go along with 774 dipoles and 224 quadrupoles. To this date four have been built and the plans for a production rate of five per week are being implemented. 5 refs.

57966 **Energy doubler vacuum devices and controls.** Bartelson, L.; Jostlein, H. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3327-3329(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The vacuum system consists of three different systems, each with its own particular characteristics and requirements: The cryostat insulating vacuum which is completely separate from the two following systems (2) cold beam tube, vacuum sections in which the beam tube is at cryogenic temperature (3) warm beam tube, vacuum sections in which the beam tube is at room temperature.

57967 **Beam transport issues in high current linear accelerators.** Miller, R.B.; Poukey, J.W.; Epstein, B.G.; Shope, S.L.; Genoni, T.C.; Franz, M.; Godfrey, B.B.; Adler, R.J.; Mondelli, A. (Sandia Natl Lab, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3343-3345(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Stable beam transport may be the limiting factor in the development of a new generation of high current linear induction accelerators. Several important beam stability topics, including radial oscillations induced by an accelerating gap, the diocotron, resistive wall, and cyclotron maser instabilities, and the transverse beam breakup and image displacement instabilities. At present image displacement appears to represent the most serious limitation to high current beam transport in linear accelerator structures. 13 refs.

57968 **Annual report 1980.** *Annual Report - European Organization for Nuclear Research;* 3-213(1981).

During 1980 the value and importance of CERN's tasks in Europe continued to be fully recognized by the Member States and despite budget difficulties it was possible to carry out fully the current programmes of the Laboratory. Although the SPS was planned to operate only for the first half of the year, its physics programme was pushed ahead with great vigour, as well as those at the ISR, PS and SC. Further important results emerged at the ISR on the production of direct photons, improving our understanding of the parton subprocesses involving gluons. For the first time, beams of alpha particles were stored in the ISR, and the alpha-proton and alpha-alpha collisions were studied at high energy. Several experiments at the ISR and SPS gave evidence on the production of charmed particles, and on their decay processes. The neutrino and muon experimental programmes have brought a wealth of new information. Experiments on the interactions of hadrons, at both high and low transverse momenta, have also progressed, those at low transverse momenta showing striking similarities with interactions produced by neutrinos. Amongst the experiments performed in the lower energy range covered by the PS, one may perhaps single out the demonstration of beam channelling by bent crystals. The SC continued the fruitful ISOLDE programme, a diversity of experiments based on muon spin rotation, and initiated the exploration of a new range of phenomena produced by intense beams of accelerated ^{12}C.

57969 **Modulator charging system upgrade for a 5-MeV electron acceleration.** Rogers, D. Jr.; Dexter, W.; Myers, A.; Reginato, L.L.; Zimmerman, A. (Lawrence Livermore Lab., CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices;* **ED-26**: No. 10, 1509-1511(Oct 1979). Contract W-7405-ENG-48.

The Lawrence Livermore Laboratory is currently constructing a new linear induction accelerator with a higher beam current than the Astron accelerator. The new accelerator, called the Experimental Test Accelerator (ETA), will be a 5-MeV, 10-kA accelerator with a pulsewidth of 50 ns. Like the Astron, the principle of magnetic induction is used to obtain a linear accelerator. The modular accelerating cavities form essentially a 1:1 transformer and the change in flux in the ferrite core induces an axial electric field for the acceleration of electrons. Since the total energy storage for the ETA is much greater than the requirement for Astron, the power system, the capacitor bank, and the modulator charging system all had to be modified to provide an overall regulation of 0.1 percent. This strict regulation of the charging voltage is necessary for pulse-to-pulse repeatability.

57970 **High intensity beam profile monitors for the LAMPF primary beam lines.** Hoffman, E.W.; Macek, R.J.; van Dyck, O.; Lee, D.; Harvey, A.; Bridge, J.; Caine, J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-26**: No. 3, 3420-3422(Jun 1979).

Two types of beam profile monitors are in use at LAMPF to measure the properties of the 800 MeV, 500 μA proton beam external to the linac. Both types use secondary electron emission from a wire to produce a current signal proportional to the amount of proton beam that intercepts the wire. The wire scanner system uses a pair of orthogonal wires which are passed through the beam and the harp system uses two fixed planes of parallel wires. Most of the harps are not retractable and are exposed continuously to the primary beam. The high beam intensities available lead to a number of technical problems for instruments that intercept the beam or are close to primary beam targets. The thermal, electrical, radiation-damage, and material selection problems encountered, and some solutions which have been implemented are discussed.

57971 **Pulsed power supply for injection bump magnets.** Praeg, W.F. (Argonne National Lab., IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Industrial Electronics and Control Instrumentation;* **IECI-26**: No. 1, 40-46(Feb 1979).

A controlled resonant circuit charges an energy-storage capacitor bank with a precision of +- 0.1% from an unregulated +- 2% dc source. The capacitor bank energizes an efficient thyristor-controlled pulse-forming discharge circuit. These circuits, which generate magnet pulses of 300 J at a rate of 30/s, are analyzed in this paper.

57972 **QUARTZ - A numerical simulation of an asymmetric electrostatic accelerator.** Wooten, J.W.; Drooks, L.J.; McCollough, D.H.; McGaffey, R.W.; Whealton, J.H. (Oak Ridge National Laboratory, Oak Ridge, Tenn.). pp 368-373 of Advances in computer methods for partial differential equations. III. Proceedings of the third international symposium, Bethlehem, PA, June 20-22, 1979. New Brunswick, NJ; International Association for Mathematics and Computers in Simulation (1979). Contract W-7405-ENG-26.

From 3. IMACS international symposium on computer methods for partial differential equation; Bethlehem, PA, USA (20 Jun 1979).

The QUARTZ computer code has been developed for modeling neutral beam injectors, including steering effects produced by offsetting one or more accelerating electrodes. The features of the code are (1) use of a finite element code to obtain solutions of Poisson's equation in an asymmetric, three-dimensional volume, (2) inclusion of space charge neutralization by electrons, and (3) inclusion of ion space charge through an iterative procedure. The physics of the problem, numerical techniques, and preliminary results are discussed.

4304 Storage Rings

REFER ALSO TO CITATION(S) 57854, 57856, 57860, 57865, 57902

57973 **Free electron laser experiment at the nsls 700 mev electron storage ring.** Blewett, J.P.; Blumberg, L.; Campillo, A.J.; DiNardo, R.P.; Hsieh, H.C.; Krinsky, S.; Luccio, A.; Pellegrini, C.; Schuchman, J.; Takacs, P.Z.; van Steenbergen, A. (Brookhaven Natl Lab, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 3166-3168(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A free electron laser experiment is described, to be performed with the 700 Mev electron storage ring of the National Synchrotron Light Source. The experiment is designed to study the parameters of the FEL in an electron storage ring and the performance of this laser as a source of short wavelength radiation in the VUV region of the spectrum. The initial experiment will be carried out at a wave length of approximately 3000 A, utilizing a permanent magnet undulator. For an average electron current of 1A distributed in three beam bunches, the small signal gain per pass (relative enhancement of the radiation intensity per electron bunch pass through the undulator) is calculated to be approximately 10%. 13 refs.

57974 **Design of muon storage rings for neutrino oscillations experiments.** Neuffer, D. (Fermilab, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 2034-2036(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A muon storage ring can provide electron and muon neutrino beams of precisely knowable flux which are excellent probes for /upsilon/ oscillations. Constraints on storage ring and injection design are described. Sample muon storage rings are presented and compared with parasitic use of the Fermilab p precooler as a /mu/ storage ring. "Stochastic injection" with injected pion beam decaying to circulating muon beam is favored. A practical possibility may be a low-energy (1 Gev) ring matched to a medium energy proton injector (8 Gev Booster). 7 refs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 56618, 58662, 58665

57975 (AD-A—108774/1) Radiation and temperature tests of cadmium telluride detectors. Research and development technical report Oct 80-Oct 81. Johnson, O.E. (Army Electronics Research and Development Command, Fort Monmouth, NJ (USA). Combat Surviellance/Target Acq. Lab.). Nov 1981. 36p. (DELCS-TR—81-3). NTIS, PC A03/MF A01.

This report describes the testing of CdTe sensors together with front end electronics is described. These new solid state sensors show promise, in terms of miniature size and sensitivity, toward the development goal of wrist-watch-sized military radiac. The unit was to operate from .01 mR/h to 1,000,000 mR/h using the least of number of sensors.

57976 (AD-A—110462/9) Studies of an optical fiber LiF dosimeter. Final report. (Harshaw Chemical Co., Solon, OH (USA)). Oct 1980. 14p. NTIS, PC A02/MF A01.

A workable system for using the absorption bands of LiF in a dosimetry system has been shown to be feasible. Small extended fibers which readily pass ultraviolet light have not yet been produced. While some additional effort in that direction would seem to be justified, an F band system based on optically clear single crystal material would seem to provide the best chance of succeeding at this moment.

57977 (DPSPU—81-30-14) Gamma monitor for assay of radioactive solid-waste shipments. Crawford, J.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Jun 1982. Contract AC09-76SR00001. 10p. (CONF-820655—8). NTIS, PC A02/MF A01. Order Number DE82020095.

From Health Physics Society annual meeting; Las Vegas, NV, USA (27 Jun 1982).

A gamma waste monitor has been developed and evaluated at the Savannah River Plant (SRP). The purpose of the monitor is to improve estimates of the radionuclides in solid wastes arriving at the plant's burial ground. This monitor, a computer-based spectrometer, quantitatively measures many radionuclides in SRP waste, including waste in heavily shielded shipping casks. Radionuclides emitting gamma rays of sufficient energy to penetrate the shipping container walls can be measured directly. Other radionuclides that are beta emitters or which emit gamma photons too weak to penetrate the walls of the waste containers can often be estimated by their association with measurable gamma photons. Development of the monitor was initiated to find a more accurate method of estimating the quantities of radioactive materials accumulated in the burial ground and to ensure compliance with burial limits imposed by SRP technical standards. Another benefit from the monitor is that it provides specific radionuclide data which are essential to environmental impact evaluations and decommissioning planning. The gamma waste monitor is described. (WHK)

57978 (EFI—483(26)-81) Calculation of the effect of the radiator thickness and angular collimation on the bremsstrahlung γ-quanta spectrum with Monte-Carlo method. Margaryan, A.T. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702303.

By means of the Monte Carlo method calculation of spectrum of bremsstrahlung γ quanta, produced at electron radiator interaction is carried out. The effect of the radiator thickness angular collimation as well as radiator γ-quanta absorption are taken into account. Moliere and Schiff accurable distributions have been used. Calculations corresponding to the electron passage with initial energy $E=3$ GeV through the lead radiators of 0.005, 0.01, 0.05, 0.1 and 0.2 thickness where X_0 is radiation length are given. Operation factor values in different energy and angular intervals are shown.

57979 (EGG-SHS—5934) Quantitative relations between beta-gamma mixed-field dosimeter responses and dose-equivalent conversion factors according to the testing standard. Gupta, V.P. (Idaho National Engineering Lab., Idaho Falls (USA)). Aug 1982. Contract AC07-76ID01570. 24p. NTIS, PC A02/MF A01. Order Number DE82018819.

The conventional two-element personnel dosimeters, usually having two thick TLD (thermoluminescent dosimetry) ribbons, are used extensively for radiation protection dosimetry. Many of these dosimeters are used for the measurement of beta and gamma radiation doses received in mixed beta-gamma fields. Severe limitations exist, however, on the relative magnitudes and energies of these fields that may be measured simultaneously. Moreover, due to a well-known energy dependence of these dosimeters, particularly for the beta-radiations, systematic errors will occur whenever the differences in workplaces and calibration radiation energies exist. A simple mathematical approach is presented to estimate the deep and shallow dose equivalent values at different energies for such dosimeters. The formulae correlate the dosimeter responses and dose equivalent conversion factors at different energies by taking into account the guidelines of the adopted ANSI Standard N13.11 and the dosimetry practices followed by most dosimeter processors. This standard is to be used in a mandatory testing program in the United States.

57980 (HMI-B—351) Formulae for spectrum fitting. Schmidt, R. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). Apr 1981. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82904612.

Portions of document are illegible.

The analysis of spectra is an important part of the interpretation of nuclear physics experiments. However, often the spectral peaks cannot be fitted properly by Gaussian (normal distribution) curves or modifications of them. Therefore, a section of the measured spectrum is often selected for use as a reference curve for the purpose of peak fitting. This report presents formulae required in the implementation of this fitting technique.

57981 (INFN/TC—81/12) Status of the acquisition system for the x-ray channel of the Wiggler Adone facility. Cavallo, N. (Istituto Nazionale di Fisica Nucleare, Naples (Italy)). 2 Jul 1981. 11p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82903261.

Portions of document are illegible.

Results are given for the testing of safety and radiation protection systems at the Wiggler Adone synchrotron facility, and a study is made of the characteristics and structure of x-ray beams. Also described are the results of absorption experiments and analyses of threshold and extended x-ray absorption fine structure. Illustrations of hardware, control and acquisition systems are also presented. 4 references, 5 figures.

57982 (INIS-mf—7090) Mathematical model and computer programme for theoretical calculation of calibration curves of neutron soil moisture probes with highly effective counters. Kolev, N.A. (Nauchno-Izsledovatelski Inst. po Pochvoznanie, Sofia (Bulgaria)). Jul 1981. 37p. (In Bulgarian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780704.

A mathematical model based on the three group theory for theoretical calculation by means of computer of the calibration curves of neutron soil moisture probes with highly effective counters, is described. Methods for experimental correction of the mathematical model are discussed and proposed. The computer programme described allows the calibration of neutron probes with high or low effective counters, and central or end geometry, with or without linearizing of the calibration curve. The use of two calculation variants and printing of output data gives the possibility not only for calibration, but also for other researches. The separate data inputs for soil and probe temperature allow the temperature influence analysis. The computer programme and calculation examples are given. (author).

57983 (INIS-mf—7116, pp vp) **Two-crystal compton polarimeter for nuclear structure measurements in ^{53}Cr and ^{55}Fe.** Byrne, A.P.; Poletti, A.R. (Auckland Univ. (New Zealand). Dept. of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

57984 (INIS-mf—7116, pp vp) **Position sensitive x-ray detector for angular distribution measurements.** Pender, L.F. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

57985 (INIS-mf—7116, pp vp) **Compensation of helical decay lines for use in position sensitive particle detectors.** Officer, V.C. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

57986 **(INIS-SU—103) Nuclear electronics. Issue 11. Theory and design of electronic equipment of physical experiment.** Agakhanyan, T.M. (ed.). (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1980. 115p. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780686.

Separate abstracts were prepared for 8 papers in this collection.

57987 **(ITEF—105(1981)) Definition of the measurement accuracy of the microobject spatial coordinates recorded by the focused image holography.** Mel'nichenko, I.A.; Silaev, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702201.

Results of experimental determination of holographic resolution of focused images scheme proposed for a vertex detector developed on the base of a bubble hydrogen chamber are presented. By means of a measuring device model the measurement accuracy of spartial coordinates of reconstructed image of the 100 μm microobjects is determined. The measurement accuracy constitutes 2.5 μm in the object plane and 30 μm in the object depth.

57988 **(JINR—R-3-81-546) Experimental investigation of polarizing mirror neutron guides. Neutron-optical characteristics.** Korneev, D.A.; Pasyuk, V.V.; Rzhany, Kh.; Shchebetov, A.F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702712.

Experimental investigation of neutron-optical characteristics of the 5-meter radially curved polarizing neutron guides at the IBR- 30 pulsed reactor (JINR, Dubna) is reported. The transmission function Tsub(exp)(lambda) was measured in the neutron wave length range from 1.0 to 4.0 A at an incident beam collimation of $0.8x10^{-3}$ rad for different angles between the neutron guide and beam axis. Using the calculation program of transmission function Tsub(id)(lambda) for ideal neutron guide, spectral and angular dependences of neutron losses in the neutron guide are determined. The transverse section of the neutron beam which escapes from the neutron guide, as well as spectrum shape with respect to detector transverse position are measured. The difference in neutron spectrum shape is observed depending on detector transverse position. The application of these neutron guides in experiment are discussed in detail.

57989 **(JINR-R—10-81-638) Base software for anti dp-experiment on the CDC-6500 computer.** Dirner, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702214.

A base software for data processing obtained from the "LUDMILA" hydrogen liquid chamber exposed in an antideuterium beam (anti dp-experiment) is described. The system consists of the HGEOKIN program for event geometrical reconstruction and kinematical identification and the HEDIT program for event selection and formation of data summary tape. The system is realised on the base of HYDRA module programming system on the CDC-6500 computer.

57990 **(JINR-R—10-81-670) Software for investigations of inclusive reactions in anti pp interactions.** Badalyan, S.G.; Batyunya, B.V.; Govorun, N.N.; Dirner, A.; Ivanov, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702215.

In connection with the inclusive reaction studying carried out on the 2 m "Ludmila" hydrogen bubble chamber in the antiproton beam the complex of programs has been created. This complex is intended for solving the following tasks: space reconstruction, combining several reconstuction results in the same event, preparing the data summary tapes. The complex has been realized on the CDC-6500 computer (JINR). It consists of the HYDRA system application programs and is used for writing permanent files on private disk packages. Using these disks for writing and reading the intermediate data provides an effective operation of central processors and minimum time of peripheral processor operation. The program chain considered allows one to handle events of any mulltiplicity with the speed of 500-600 event per hour.

57991 **(SAND—82-1495) Use of nuclear instrument modules (NIM) for lead and arsenic counting systems.** Bonaparte, S.D. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1982. Contract AC04-76DP00789. 11p. NTIS, PC A02/MF A01. Order Number DE82020421.

This paper describes an economical lead counting system for the measurement of DT (14 MeV) neutrons and an arsenic counting system for the measurement of DD neutrons (2.5 MeV). These systems can be readily assembled from commercially-available equipment.

57992 **(ZfK—433(v.2)) Proceedings of the 10. International Symposium on Nuclear Electronics.** Flaemig, E.; Koenig, K.H. (eds.). (Joint Inst. for Nuclear Research, Dubna (USSR); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic)). Feb 1981. 342p. (CONF-8004215—(Vol.2)). NTIS (US Sales Only), PC A15/MF A01. Order Number DE82702197.

From 10. international symposium nuclear electronics; Dresden, German Democratic Republic (10 Apr 1980).

The report comprises lectures given at the X. International Symposium on Nuclear Electronics. Volume II comprehends essential topics to the development of computerized systems and the application of CAMAC modules and their connection with microprocessors in the field of high energy physics. Volume II is divided in two sections. Section C: measuring electronics in high energy physics. Section D: application of computer aided systems in experiments with special regard to microcomputer and CAMAC system.

57993 (ZfK—433(v.2), pp 24-37) **High rate pulse processing systems for silicon active targets.** Artuso, M.; D'Angelo, P. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)); Gatti, E. (Politecnico di Milano (Italy). Ist. di Fisica); Manfredi, P.F. (Pavia Univ. (Italy)); Marioli, D. (Politecnico di Milano (Italy). Centro Studi Nucleari E. Fermi). Feb 1981. Dep. NTIS (US Sales Only).

From 10. international symposium nuclear electronics; Dresden, German Democratic Republic (10 Apr 1980).

The theoretical part of this paper is focused on the choice of the preamplifier and on the comparison between time-variant and time-invariant pulse processing for this particular set of applications. The points covered by the analysis are: limitations of transformer-coupled preamplifiers, fast cold-resistence charge-sensitive loops and count-rate performances of gated filters and transversal filters. Upon the conclusions of the evaluation analysis a new pulse processing system has been based. It was implemented with the purpose of reaching a count-rate capability of 10^6 pulses per second. The processor consists of a fast preamplifier followed by a triangular shaper delivering a 100ns-wide pulse. The shaper employs a coaxial-cable transversal filter. The complete system which serves 30 silicon detectors is described, and its performances in terms of energy resolution, counting rate capabilities and stability are given.

57994 (ZfK—433(v.2), pp 61-72) **Line track detection with fast bit-slice microprocessors.** Stuckenberg, H.J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1981. (In German). Dep. NTIS (US Sales Only).

From 10. international symposium nuclear electronics; Dresden, German Democratic Republic (10 Apr 1980).

A bit-slice microprocessor is described which renders possible to calculate the track-coordinates of selected events. The microprocessor is constructed with fast hardware and software. The hardware is described in detail and the problems of the software are discussed. The results of the calculation of the track coordinats as well as the radius and the tangent of the track are figured. They demonstrate that the microprocessor works effectively as an event filter.

57995 **(ZfK—461) Position-sensitive ionization chamber for a time-of-flight spectrometer.** Manfrass, P.; Schilling, K.D.; Seidel, W.; Sodan, F.; Stary, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Nov 1981. 11p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702198.

The construction and working principles of a position sensitive ionization chamber are described, which is used for the time-of-flight spectrometer DEMAS. The whole set-up gives information on the energy, the time-of-flight and the coordinates of a detected HI-reaction product. Also the differential energy lost for Z-identification can be determined. The results for each parameter are given.

57996 **(ZfK—464) Electronical set-up and on-line data processing for the determination of the cross section of the reaction ^{1}H(n,d)γ.** Hutsch, J.; Moesner, J.; Schmidt, G.; Stiehler, T.; Kudin, L.G.; Spiridenkov, E.M.; Volkov, S.S. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jan 1982. 9p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702199.

After a brief description of the physical problem the electronical set-up for the investigation of the reaction ^{1}H(n,d)γ at Esub(n) = 25 MeV and the connection with the on-line computer are described in the first part of the present work. The second part includes the software and the data handling.

57997 **(ZJE—235) Activation method for determining neutron spectra and fluences.** Hogel, J.; Vespalec, R. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1980. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702200.

3 mm thick foils of 4 and 17 mm in diameter were used for measurements. NaI scintillation detectors 45 mm in diameter by 50 mm thick and 40 mm in diameter by 1 mm thick, and a Ge-Li spectrometer of 53 cm^3 in volume were used for gamma detection. A photopeak or a certain part of the integral spectrum was measured for each radionuclide. Computer code PIKAR was applied in automatic calculation of a simple gamma spectrum obtained using the semiconductor spectrometer. The FACT code was used for calculating foil activity. Codes SAND II and RFSP were used for neutron spectra unfolding. Ge-Li detector spectrometry was used for determining neutron fluence. Code FLUE was used for determining the mean value of neutron flux density and fluence.

57998 **Automatic readout micrometer.** Lauritzen, T. (to Department of Energy). US Patent 4,320,577. 23 Mar 1982. Filed date 4 Aug 1979. vp. PAT-APPL-045170.

A measuring system is disclosed for surveying and very accurately positioning objects with respect to a reference line. A principal use of this surveying system is for accurately aligning the electromagnets which direct a particle beam emitted from a particle accelerator. Prior art surveying systems require highly skilled surveyors. Prior art systems include, for example, optical surveying systems which are susceptible to operator reading errors, and celestial navigation-type surveying systems, with their inherent complexities. The present invention provides an automatic readout micrometer which can very accurately measure distances. The invention has a simplicity of operation which practically eliminates the possibilities of operator optical reading error, owning to the elimination of traditional optical alignments for making measurements. The invention has an extendable arm which carries a laser surveying target. The extendable arm can be continuously positioned over its entire length of travel by either a coarse or fine adjustment without having the fine adjustment outrun the coarse adjustment until a reference laser beam is centered on the target as indicated by a digital readout. The length of the micrometer can then be accurately and automatically read by a computer and compared with a standardized set of alignment measurements. Due to its construction, the micrometer eliminates any errors due to temperature changes when the system is operated within a standard operating temperature range.

57999 **Spin precession resonance spectrometer.** Felcher, G.P.; Carpenter, J.M. (Argonne National Lab., IL (USA)). *Nuclear Instruments and Methods in Physics Research;* **192**: No. 2/3, 513-522(1 Feb 1982).

We present the concept of a new neutron scattering instrument to be used at a pulsed neutron source. The machine, which starts as a development of the resonance detector spectrometer and incorporates the basic ideas of spin precession energy analysis, is suited for the study of medium- and high-energy excitations in solids and liquids, particularly at small momentum transfers. The most novel characteristic of its performance is a high resolving power, achieved without appreciable loss of neutron flux. In an alternative operation (and sacrificing resolution) the instrument is capable of separating spin-dependent from spin-independent scattering processes.

58000 **Thermal neutron coincidence counting system.** Erkkila, B.H.; Marshall, R.S. (Los Alamos Sci Lab, NM). *Nuclear Technology;* **50**: No. 3, 307-313(Oct 1980).

The thermal neutron coincidence counter (TNC) is one of a variety of instruments used in the Plutonium Processing Facility at the Los Alamos Scientific Laboratory (LASL) for nondestructive assay (NDA) of spontaneously fissioning material, such as plutonium in powder, scrap, and metal. 2 refs.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 56730, 57472, 58632

58001 **(AD-A—109691/6) Hardness assurance latchup test procedure. Final report, 25 April 1977-28 August 1978.** Witteles, A.A. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). 28 Aug 1978. 21p. NTIS, PC A02/MF A01.

This test procedure defines the detailed requirements for gamma dose rate testing of semiconductor integrated circuits to determine if they are susceptible to radiation-induced latchup. This test is not deleterious, and devices which have been subjected to and passed the test may be used as production hardware. There are two types of radiation-induced latchup: (1) a hard latchup, and (2) an incipient latchup. A hard latchup is a sustained functional failure. The erroneous operational condition can be stopped by cycling bias power if burnout has not occurred in the interim. Incipient latchup is characterized by a functional failure which is not sustained, but which lasts longer than can be explained by normal circuit time constants. Identification of a latchup-susceptible IC is accomplished by identifying erroneous operating states immediately after radiation exposure by exercising the device with a functional test.

58002 **(AD-A—109700/5) Radiation effects on transmission in optical fiber systems. Final report 1980-1981.** Hilarides, W.H. (Naval Academy, Annapolis, MD). 2 Jun 1981. 51p. (USNA-TSPR—110). NTIS, PC A04/MF A01.

A study was done of the effects of 14.7 MeV neutrons on transmission in optical fibers. This study was done with monochromatic light in the spectral range from 700 to 1700 nanometers. Of the fibers studied, two were high purity silica fibers, and two were Germanium doped core silica fibers. An important result of the study was that the radiation induced damage was wavelength related. The induced damage decreased rapidly as the wavelength increased from 800 to 1100 nanometers, with minimal damage noted above 1300 nanometers. This trend was due primarily to the energy levels of traps formed as the bombarding neutrons broke bonds within the silica. Several other interesting trends were noted. First, the water content of the fiber affected the amount of induced damage. Second, the method by which the fiber was made affected the damage levels. Third, the dopant used affected the damage levels. These trends deserved further study, but because the data base was so small, more specific conclusions were not possible.

58003 **(AD-A—110263/1) Essential pattern and sequence sensitivity in semiconductor memories.** Tuszynski, A. (Minnesota Univ., Minneapolis (USA). Dept. of Electrical Engineering). 15 Jul 1980. 101p. NTIS, PC A06/MF A01.

Pragmatic classification of errors linked to a study of Essential Pattern and Sequence Sensitivity leads to a new and credible strategy for the validation of individual chips and entire memories. Three categories or errors are recognized: hard, non-random soft and random soft errors. Progress in the verification of VLSI devices is predicated on the availability of diagnostic instrumentation. Three promising techniques are being developed: (1) Stroboscopic Scanning Electron Microscopy; (2) the Zero-Capacitance Probe; and (3) Pseudo Analog Testing. More attention must also be given to the matter of process statistics. Lastly, much remains to be done at the system level. We consider error correction of the Hamming-code variety as a particularly efficient technique of fault-tolerant design and we discuss chip and system architectures for reduction of the risk of burst errors. All in all we advocate (1) conventional testing for hard errors attributable typically to stuck-at-faults, (2) extensive analysis and diagnostics for non-random soft errors produced more often than not by crosstalk manifested as Pattern or Sequence Sensitivity, and (3) block-oriented error correction for random errors induced most often by alpha particles and cosmic rays.

58004 **(AD-A—111047/7) Radiation effects in pigtailed GaAs and GaAlAs LEDs. Final report, 12 Feb 79-30 Sep 80.** Barnes, C.E. (Sandia Labs., Albuquerque, NM (USA)). Jun 1981. Contract AC04-76DP00789. 115p. (SAND—81-0929). NTIS, PC A06/MF A01.

Permanent and transient radiation effects have been studied in Plessey pigtailed, high radiance GaAs and GaAlAs LEDs using neutron, gamma ray and X-ray sources. The radiation-induced source of degradation in these devices was determined by also examining both bare, unpigtailed LEDs and separate samples of the Corning fibers used as pigtails. No transient effects were observed in the unpigtailed LEDs during either pulsed neutron or X-ray exposure. In contrast, the Corning doped silica fibers exhibited strong transient attenuation following pulsed X-ray bombardment. Permanent neutron damage in these pigtailed LEDs consisted essentially of light output degradation in the LED itself. While this effect was significant, it is important to note that these LEDs have exceptionally good neutron tolerance in that their average light output degrades by only a factor of 1.7 at fluences near 1 x 10(to the 14th power)n/sq cm. Permanent gamma ray effects due to a Co-60 irradiation of 1 megared were restricted to a small increase in attenuation in the fiber. The two primary radiation effects were then transient attenuation in the fiber pigtail and permanent neutron-induced degradation of the LED.

58005 **(SAND—81-2140) Soft-error susceptibility of a CMOS RAM: dependence upon power-supply voltage.** Kolasinski, W.A.; Koga, R.; Blake, J.B.; Diehl, S.E. (Sandia National Labs., Albuquerque, NM (USA); Aerospace Corp., Los Angeles, CA (USA). Space Sciences Lab.; Auburn Univ., AL (USA). Dept. of Electrical Engineering). May 1982. Contract AC04-76DP00789. 9p. NTIS, PC A02/MF A01. Order Number DE82015654.

Two types of delidded CMOS 1024 x 1 RAM (Harris HM 6508-RH and Sandia TA597) have been tested for susceptibility to soft bit errors caused by 150-MeV krypton ions. Bit-error susceptibility was measured as a function of bias voltage and exposure angle with respect to the chip normal. Comparison of measured bit-error rates and thresholds with those computed by use of a simple device model and manufacturer-supplied data shows good agreement in some respects while raising questions in others. In the case of the HM6508-RH RAMs, measured values of critical charge of 1 pC and 2 pC at 5V and 7V, respectively, indicate that the devices can be expected to show bit-error rates in space of approximately 1 x 10^{-5} per chip per day at 7V bias.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 56473, 56612, 56716, 56751, 56833, 56836, 57370, 57380, 57504, 57556, 58048, 58069, 58595

58006 **(BDX—613-2658R) Quadrature-error-correction techniques for the HP8542A ANA.** Taylor, J.L. (Bendix Corp., Kansas City, MO (USA)). 1981. Contract AC04-76DP00613. 14p. (CONF-810793—1). NTIS, PC A02/MF A01. Order Number DE82015427.

From Workshop on automatic radio frequency measurements; Los Angeles, CA, USA (1 Jul 1981).

Quadrature error may be defined as the deviation from linearity of the detected magnitude and phase of the input signals in an automatic network analyzer. Quadrature error affects normal automatic network analyzer calibration parameters. Direct measurement of quadrature error involves measurement of the test channel amplitude and the test channel phase at the input to the attenuators controlling the signal amplitude to the quadrature detector. These measurements are then compared to the digitized components. A far less laborious indirect measurement method involves using the automatic network analyzer in a normal operating mode after normal calibration and making measurements of a precision air line. The measured data are then evaluated for deviations from linearity as a function of the measured phase. This method adds some error due to inaccuracy in calibration, but its effects may be reduced. Once the quadrature error is known, a Fourier series curve fit may be used to correct for it. (LEW)

58007 **(BDX—613-2787) RF characterization of semiconductors. Final report.** Thomas, A.G. (Bendix Corp., Kansas City, MO (USA)). Jun 1982. Contract AC04-76DP00613. 44p. NTIS, PC A03/MF A01. Order Number DE82016995.

A capability to perform RF characterization and a program for providing RF performance assurance for semiconductor devices were developed to support new advanced weapon systems with all solid-state radars. This report summarizes the activities performed at Bendix Kansas City since 1972 and the conclusions formulated on the characterization of various categories of bipolar microwave devices.

58008 **(DPSPU—81-30-9) Automated mass-spectrometer system for measuring uranium and plutonium process streams.** Boyce, W.B.; Goergen, C.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1981. Contract AC09-76SR00001. 10p. (CONF-811025—26). NTIS, PC A02/MF A01. Order Number DE82020068.

From 25. conference on analytical chemistry and nuclear technology; Gatlinburg, TN, USA (6 Oct 1981).

A Varian Mat 260 Automated Thermal Ionization Mass Spectrometer System was purchased by the Savannah River Plant (SRP) and recently installed by Varian Factory representatives to meet the requirements of the SRP Safeguards program. This instrument features many new innovations in mass spectrometers. The most novel is a 23 cm radius magnetic sector that provides the same dispersion as a 46 cm radius sector by using off-axis ion beam entry and exit to the magnetic field. Up to 13 samples may be loaded at one time because the source housing is designed to receive a carrousel holding up to 13 dual filament assemblies. The dual Faraday Cup collector system is designed to measure simultaneously two uranium or plutonium masses, three mass units apart. A Hewlett Packard 9825-A calculator and a Varian developed software package controls filament heatup cycles, sample preconditioning, ion beam focusing, carrousel rotation and mass selection. The calculator also performs data acquisition services with a hard copy printout. A glove box train provides containment for radioactive sample preparation and filament plating. It also provides the necessary containment for the mass spectrometer ion source and a separate preconditioner without having to remove the loaded sample carrousel from the glove box train.

58009 (EFI—488(31)-81) Statistics of electron multiplication in microchannel plates. Akhperdzhanyan, A.G.; Margaryan, Yu.L. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701857.

Kinetic equations for the probabilities of different values of the multiplication coefficient for microchannel plates are set up and solved. The fluctuations of the multiplication coefficient are shown to obey the Polya statistics in the model under consideration.

58010 (LA-UR—82-1425) Metallograph for the examination of low-level radioactive samples. Cook, J.H.; Shaffer, D.S.; Petty, W.F. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-820609—31). NTIS, PC A02/MF A01. Order Number DE82015729.

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

A new remote-controlled metallograph was built for use in a low-level radiation background. The metallograph is low cost compared to a conventional remote-controlled metallograph. The motors that drive the stage motions and focus are commercially available and attach to the metallograph without modification. The metallograph was installed on a drawer in a blister behind a shielding door. This allows the metallograph to be reached quickly and easily for maintenance and repair.

58011 (NUREG/CR—2264) Characterization methods for ultrasonic test systems. Busse, L.J.; Becker, F.L.; Bowey, R.E.; Doctor, S.R.; Gribble, R.P.; Posakony, G.J. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 55p. (PNL—4215). NTIS, PC A04/MF A01 - GPO $5.00.

Methods for the characterization of ultrasonic transducers (search units) and instruments are presented. The instrument system is considered as three separate components consisting of a transducer, a receiver-display, and a pulser. The operation of each component is assessed independently. The methods presented were chosen because they provide the greatest amount of information about component operation and were not chosen based upon such conditions as cost, ease of operation, field implementation, etc. The results of evaluating a number of commercially available ultrasonic test instruments are presented.

58012 (PTB-E—19) Wide-band E/H field sensing probes: A discussion of probe interactions and coupling problems. Lindsay, J.E. Jr. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Elektrizitaet). Oct 1981. 78p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

This report will discuss a variety of problems encountered in the development of a wide-band E-and H field probe. This probe is to cover the frequency range of a few tenths of a megahertz to approximately 10 MHz. Time harmonic (i.e., sinusoidally varying) fields are to be measured; the E-and H field ellipses are to be determined and also the resulting Poynting vector.

58013 (UUIP—1052) Electron spectroscopy for atoms, molecules and condensed matter. Siegbahn, K. (Uppsala Univ. (Sweden). Fysiska Institutionen). Dec 1981. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702497.

A review is given of the research performed at the Institute of Physics, Uppsala under the direction of Prof. Siegbahn. in the field of electron spectroscopy applied to solids, liquids and gases. The developemnt of the spectroscopic methods is the central theme of the review.

58014 Self-heated thermocouples for far-infrared detection. Neikirk, D.P.; Rutledge, D.B. (Division of Engineering and Applied Science, California Institute of Technology, Pasadena, California 91125). *Applied Physics Letters;* **41**: No. 5, 400-402(1 Sep 1982). Contract AM03-76SF00010.

A novel self-heated Bi-Sb thermocouple for far-infrared detection has been developed. The detector is suitable for integration with monolithic antennas and imaging arrays. The device is fabricated in a single photolithography masking step using a photoresist-bridge technique. This bridge technique has also been used to make microbolometers with lower 1/f noise than those made by two conventional masking steps. The thermocouples have a noise equivalent power (NEP) of 7×10^{-10} W/($\sqrt{}$Hz) and a 3-dB frequency response of 150 kHz.

58015 Direct detection of vacuum ultraviolet scintillations in liquid helium using germanium photodiodes. Luke, P.N.; Steiner, H.M.; Haller, E.E. (Lawrence Berkeley Laboratory and University of California, Berkeley, California 94720). *Applied Physics Letters;* **41**: No. 4, 315-317(15 Aug 1982). Contract AC03-76SF00098.

Direct detection of vacuum ultraviolet scintillations in liquid helium produced by 5.3 MeV α particles has been accomplished using a high-purity germanium photodiode. The diode was immersed in the liquid helium and operated in the side-entry mode with a senstive area of 0.3×1.0 cm. Scintillation from each α particle was detected as a single pulse. A signal rise time <0.1 μs was obtained at an electric field $>$ or ≈ 1200 V cm^{-1}. The quantum efficiency of the photodiode was estimated to be ~ 4.

58016 Broadband triboluminescence in silica core fiber optic waveguides. Smiel, A.J.; Fischer, T.A. (Electro-Optics Division, 2152, Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **41**: No. 4, 324-326(15 Aug 1982). Contract AC04-76DP00789.

This letter describes the first observation of broadband, shock-induced luminescence in silica core fiber optic waveguides on a single-event basis. Spectra recorded with an optical multichannel analyzer suggest that at least two different types of luminescence centers are responsible for this emission. The degree to which each type of luminescence center is created and/or excited is found to depend upon the detailed dynamics of the crushing.

58017 Imaging antenna array at 119 μm. Neikirk, D.P.; Tong, P.P.; Rutledge, D.B.; Park, H.; Young, P.E. (Division of Engineering and Applied Science, California Institute of Technology, Pasadena, California 91125). *Applied Physics Letters;* **41**: No. 4, 329-331(15 Aug 1982). Contract AM03-76SF00010.

A focal-plane imaging antenna array has been demonstrated at 119 μm. The array is a line of evaporated silver bow-tie antennas with bismuth microbolometer detectors on a silicon substrate. Radiation is coupled into the array by a lens placed on the back of the substrate. The bolometers are thermally isolated from the silicon substrate with a half-micron layer of polyimide. The array performance is demonstrated by coherent imaging of a series of holes at half the diffraction-limited cut-off frequency.

58018 Deep level transient spectroscopy using CAMAC components. Jervis, T.R.; Teter, W.M.; Cole, T.; Dunlavy, D. (Los Alamos National Laboratory, P.O. Box 1663, MS D429, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **53**: No. 8, 1160-1162(Aug 1982). Contract W-7405-ENG-36.

Apparatus for computer-controlled acquisition of capacitance transient data for deep level analysis is described. The system is configured for either electrical or optical excitation of deep levels in GaAs and is based on the highly flexible CAMAC interface. The system is designed to collect transient spectroscopy data in as simple a form as possible and to make use, as much as possible, of commercially available apparatus of resonable cost. Hardware requirements and connections are described as are software for data acquisition and analysis.

58019 **Reply to "Comment on 'Thermocouple temperature measurements in shock-compressed solids' ".** Bloomquist, D.D.; Sheffield, S.A. (Sandia National Laboratory, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **53**: No. 8, 5964-5965(Aug 1982). Contract AC04-76DP00789.

We disagree with the interpretation offered in the above comment. The suggestion was made that the anomalously fast response of thin-foil thermocouples reported previously is the result of strain dependence of the thermocouple response and not shock enhanced thermal equilibration. Although the emplacement geometry has a profound effect on the response of embedded thin-foil temperature gauges as noted in the above comment, the evidence presented, along with recent results discussed in this reply, do not support the conclusions presented in the above comment.

58020 **Remote lapse-rate sensing using atmospheric refraction over complex terrain.** Porch, W.M.; Green, T.J. (University of California, Lawrence Livermore National Laboratory, California 94550). *Applied Optics;* **21**: No. 6, 981-982(15 Mar 1982). Contract W-7405-ENG-48.

A technique for continuous remote lapse-rate measurements using atmospheric refraction over complex terrain has been developed. Using a vertically oriented 1024 element linear photodiode array at the focus of a C-90 Celestron to detect laser radiation, the lapse rate of the Big Sulfur Creek Valley was determined. (AIP)

58021 **Multiple-pass reflectometer.** Edwards, D.F. (Los Alamos National Lab., NM); Baumeister, P. *Applied Optics;* **20**: No. 22, 3968-3971(15 Nov 1981).

The multiple-pass reflectometer has been shown to be a convenient and precise instrument for measuring absolute spectral reflectance values in excess of 0.99. Given here is an extension of earlier work. We present details of the setup, operation, parameter optimization, and some limitations of the reflectometer. For a carefully aligned instrument the precision of the measurement is limited by the uncertainty in the computer fit of a straight line to the data. For the uv and visible spectral regions, typical reflectance precision is a few parts in 10^4. Systematic errors due to nonuniform photosurfaces and astigmatism have been minimized for the setup described here.

58022 **Determination of plate contours with a servo-scanning interferometer.** Primak, W. (Argonne National Lab., IL). *Optical Engineering;* **20**: No. 3, 481-485(May 1981).

The history of Badoz's principle of linear detection of fringes having a potential precision of 5 x 10^{-6} orders and its applications to the measurement of birefringence, to ellipsometry, and to interferometry are given. The application of the principle to a servo-scanning interferometer (Twyman-Green configuration) for the calibration of the instrument, the analysis of the data, and the determination of the absolute contour of small plates is described. The problems of the interferometry and the determination of absolute contours, and the prospects for improving the precision from that attained, 1/70 fringe, to the very much greater potential of Badoz's principle are discussed.

58023 **Ultraviolet spectrograph lens.** Brixner, B.; Winkler, M.A. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **288**: 12-14(1981).

A 700-mm f/4.7 spectrograph camera lens was designed for imaging spectral lines in the 200 to 400-nm region on a 120-mm flat image field. Lens elements of fused silica and crystalline calcium fluoride have so little secondary spectrum that raytracing calculations predict a monochromatic resolution limit of 30 lines/mm without refocusing in the 238- to 365-nm region. Light scattering at the polished calcium-fluoride surfaces is avoided by sandwiching the fluoride elements between fused silica and cementing with silicone fluid. The constructed lens makes good spectrograms.

58024 **Multi-anode microchannel arrays.** Timothy, J.G. (Colorado, University, Boulder, Colo.); Mount, G.H. (Ball Corp., Ball Aerospace Systems Div., Boulder, Colo.). pp 360-368 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

The Multi-Anode Microchannel Arrays (MAMA's) are a family of photoelectric, photon-counting array detectors being developed for use in instruments on both ground-based and spaceborne telescopes. These detectors combine high sensitivity and photometric stability with a high-resolution imaging capability. MAMA detectors can be operated in a windowless configuration at extreme-ultraviolet and soft X-ray wavelengths or in a sealed configuration at ultraviolet and visible wavelengths. Prototype MAMA detectors with up to 512 x 512 pixels are now being tested in the laboratory and telescope operation of a simple (10 x 10)-pixel visible-light detector has been initiated. The construction and modes-of-operation of the MAMA detectors are briefly described and performance data are presented.

58025 **Subnanosecond detector developments at ITT.** Eberhardt, E.H. (ITT Tube and Sensor Laboratories, Fort Wayne, IN). pp 369-377 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

This paper describes the performance characteristics of the following four new types of subnanosecond optical detectors: (1) a triplanar phototube with 100-150 ps FWHM response and less-than-unit gain, (2) a microchannel plate photomultiplier tube with 300-500 ps FWHM response and up to one-million gain, (3) a magnetically focused, electrostatically deflected streak tube with a 10 ps time resolution capability, and (4) an all-electrostatic circular-scan streak tube with a 7 ps time resolution capability. The first two detectors convert a fast input optical pulse, or chain of pulses, directly to a fast output pulse (or output pulse chain) in a coaxial transmission line, while the latter two detectors convert a fast input optical pulse to an intensity-modulated, spatially distributed output optical image.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 56118

45 EXPLOSIONS AND EXPLOSIVES

58026 **(SAND—82-0831) Computer simulations of 75-mm projectiles impacting sand targets.** Montgomery, S.T. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1982. Contract AC04-76DP00789. 53p. NTIS, PC A04/MF A01. Order Number DE82015796.

Results from numerical simulations of two 75 mm projectile designs impacting and penetrating at normal incidence into sand at 3000 ft/sec are described. The results indicate similar behavior for both designs. During penetration the front of the projectiles deformed plastically so that as the projectile penetrated into the sand a plastic deformation or crushing front moved from the front end of the projectile towards its back end. Accelerations at the front of the projectiles are given and compared with experimentally determined accelerations for similar conditions.

4501 Chemical

REFER ALSO TO CITATION(S) 56011, 57752, 58031, 58036, 58037, 58041

58027 **(BF-R—64.176-64.181-1) Detonation-like explosion modes. Interim report, August 1979-December 1980.** Geiger, W.; Rischbieter, F.; Stock, M.; Synofzik, R.; Moen, I.; Wilson, C.W. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Feb 1981. 303p. (In German and English). Dep. NTIS (US Sales Only), MF A01. Order Number DE82904639.

Portions of document are illegible.

In the majority of the experiments performed until now, the average flame speeds in the region outside of the partial confinement have been observed to be in the range between 320 and 750 m/s with peak overpressures up to 1.1 bar. These unexpectedly large figures may be explained by the rapid increase of the flame surface area in the outside region due to convection of the flame by the unsteady free jet from the orifice. In the case of cylindrically expanding deflagrations flame speeds of up to 400 m/s with corresponding overpressures of up to 0.64 bar have been observed, in the case of deflagrations within tubes the flame front velocities amounted up to 900 m/s. In order to obtain a rough estimate of the range of overpressures and wave velocities from the interaction between a blast wave and a flame front, calculations have been made for the incidence of a plane shock wave from behind on a plane flame front. The experimental setup has been designed and constructed on the basis of these estimates. Theoretical analyses and numerical calculations demonstrate that the temperature rise due to radian preheating is limited and the corresponding increase in flame velocity and explosion pressure is small in the case of a fuel/air cloud uniformly loaded with dust. The situation can be much more severe in the case of an isolated dust pocket within the fuel/air cloud. In this case radiation transport by remote heating is effective, hence there may be excessive preheating of the dust pocket.

58028 **(SAND—82-0198C) Comparison of TiH/sub x/- and ZrH/sub x/-$KClO_4$ pyrotechnics.** Lieberman, M.L.; Carlson, R.S.; Rittenhouse, C.T.; Fronabarger, J.W. (Sandia National Labs., Albuquerque, NM (USA); Mound Facility, Miamisburg, OH (USA); Unidynamics/Phoenix, Inc., AZ (USA)). 1982. Contract AC04-76DP00789. 16p. (CONF-820710—6). NTIS, PC A02/MF A01. Order Number DE82015262.

From 8. international pyrotechnics symposium; Steamboat Springs, CO, USA (12 Jul 1982).

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Pyrotechnic properties of ZrH/sub x//$KClO_4$ blends have been compared with those previously obtained for TiH/sub x//$KClO_4$ blends. The results indicate that the dependence of spark sensitivity on fuel microstructure found for the latter materials also exists for the former. Bridgewire ignition data for the ZrH/sub x//$KClO_4$ blends show that the subhydrides are more sensitive than the dihydride. Results of ballistic output testing show that the ZrH/sub x//$KClO_4$ blends yield lower outputs than those achieved with TiH/sub x//$KClO_4$ blends.

58029 **(UCRL—83838) Gruneisen-parameter measurements for high explosives.** Bloom, G.H. (Lawrence Livermore National Lab., CA (USA)). 23 Jun 1981. Contract W-7405-ENG-48. 6p. (CONF-810684—54). NTIS, PC A02/MF A01. Order Number DE82006733.

From APS conference on shock waves in condensed matter; Menlo Park, CA, USA (23 Jun 1981).

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The Grueneisen parameter of the explosives PBX-9404 and RX-03-BB have been measured at full and reduced density. The samples were heated in 40 ns with a 2 MeV electron beam and the pressure developed was determined with a laser interferometer.

4502 Nuclear

REFER ALSO TO CITATION(S) 57752, 57911, 58055, 58129, 58323

58030 **(AD—341048/7) Underwater pressure measurements in the lagoon.** Rollosson, G.W. (Sandia Corp., Albuquerque, NM (USA)). Apr 1953. 24p. NTIS, PC A02/MF A01.

On Mike shot of Operation Ivy measurement of underwater pressures was attempted at four locations near the floor of the lagoon. Gauges were installed at distances ranging from approximately 5700 to 112,000 ft from ground zero and about 1 mile from the reef. The single usable record showed sharp pressure spikes at 0.3 and 0/6 sec after zero time. Although the later spike corresponded with the time of arrival of the air shock at the surface of the lagoon above the gauge, no satisfactory explanation for the first spike has been found. Because two of the four gauges used were apparently faulty in their operation and the recorder to which a third was connected failed to start at all, it was impossible to draw any conclusions regarding the nature or magnitude of the underwater shock.

58031 **(AD—357978/6) Minefield clearance.** Richmond, O. (Army Engineer Research and Development Labs., Fort Belvoir, VA (USA)). Feb 1954. 104p. NTIS, PC A06/MF A01.

The specific objectives of the study were: (1) to determine the validity of using standard Universal indicator mine calibration constants for predicting live mine detonations under nuclear bursts, (2) to determine the effect of depth of mine burial on detonation by a nuclear burst, (3) to study the effect of sympathetic detonation in extending the radius of mine clearance under a nuclear burst; and (4) to correlate the actual mine detonation results with the basic blast parameters produced by a nuclear burst. Two thousand indicator mines and 1200 live mines were exposed to one nuclear explosion (Shot 10), in various special patterns extending out to 2700 ft from intended ground zero. Results of the test showed conclusive evidence of the ability of nuclear explosions to clear large paths through minefields. All M6 and M15 antitank mines that were buried within 6 in. of the ground surface were detonated out to 1550 ft from actual ground zero, and all M14 antipersonnel mines buried at the ground surface were detonated out to 1650 ft from actual ground zero.

58032 **(AD—362095/2) Air pressure measurements.** Swift, L.M.; Wells, E.J. (Stanford Research Inst., Menlo Park, CA (USA)). May 1955. 116p. NTIS, PC A06/MF A01.

Project 3.1 of Operation CASTLE was concerned with the measurement of pressures existing on the surfaces of a non-responsive cubical structure from Shot 3. The analysis of data was not a portion of this particular project but the data will be analyzed by other agencies and used in computations of structural loading under air blast. The definition of free-field conditions in the vicinity of the structure constituted a vital portion of the project. Free-field conditions have been analyzed and the results are included in this report. Of a total of 65 gages, 63 gave usable data, which are reported in the form of both tracings and tabulations. One Q gage and one pressure gage gave recordings which are obviously wrong and these data are therefore not reported. Due to the low yield of the shot, conditions were far from optimum so that the usefulness of the data was impaired.

58033 **(AD—370261/0) Effect on engineer bridging equipment.** Moore, G.T. (Army Engineer Research and Development Labs., Fort Belvoir, VA (USA)). Feb 1954. 122p. NTIS, PC A06/MF A01.

The purpose of Project 3.22, Operation UPSHOT-KNOTHOLE, was to indicate the vulnerability of Army prefabricated fixed bridging to atomic blast and to determine means to reduce the vulnerability. To accomplish this, two 100-ft Bailey bridge spans were erected such that one was exposed to Shot 9 and both were exposed to Shot 10 of the test series; and two single bay sections of bridging were erected to afford a comparison between Bailey and T6 bridging. The presence of a precursor wave and high dynamic pressures in the region of interest for Shot 10 severely limited the value of the results of that part of the experiment. Results indicate that an anchor cable would be the best means of limiting the response of such a bridge.

58034 **(AD—465294/7) Blast effects on tree stand.** Fons, W.L.; Storey, T.G. (Department of Agriculture, Washington, DC (USA)). Mar 1965. 48p. NTIS, PC A03/MF A01.

The tree stands on three separate islands varied from 29 to 170 acres in area with vegetation composed of broadleaf trees up to 80 ft tall and coconut palms about 40 ft tall. Several palms on the three islands were equipped with snubber wire arrangement for measuring maximum deflection. The large stand was instrumented with 16 selfrecording ground-level static overpressure gages at eight locations and two self-recording dynamic pressure gages at two locations; the two smaller stands were instrumented with two static overpressure gages each. Sample plots were established on two islands for assessing stem and limb breakage in more detail. Ground-level pressure measurements lengthwise of a large stand showed no attenuation in peak static overpressure. It was not possible to evaluate the degree of peak dynamic pressure attenuation because gages both in front of and inside the tree stand measured unrealistically high peak dynamic pressure compared to values calculated from corresponding peak static overpressure measurements. Nonuniform character of stands prohibited evaluation of shock attenuation from observations of tree damage with distance. The damage to the broadleaf trees was principally crown damage with occasional stem breakage or uprooting. The type of damage experienced was similar for moderate and high yield weapons. Observed damage from two weapons of different yields compare favorably with isodamage curves prepared for broadleaf stands.

58035 **(AD-A—108989/5) Cratering capabilities of low-yield nuclear weapons. Final report.** Strange, J.N. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.). Jul 1981. 32p. NTIS, PC A03/MF A01.

A review of past cratering experiments, both from high explosives and nuclear explosives, was conducted and the data gathered were analyzed in order to develop a generalized empirical method for predicting crater dimensions when only qualitative information on the media cratered is available. The methods developed enable crater predictions to be made in homogeneous and layered media within the stated orders of scatter. It is believed that the probability of a given crater falling within the predicted values is in the range of 0.8.

58036 **(AD-A—109480/4) Fiber Optic CODEC Link (FOCOL). Volume 1. Final report, 1 November 1978-26 January 1981.** Naumann, W.; Liles, E.; Hogg, R.D. (Effects Technology, Inc., Santa Barbara, CA (USA)). 26 Jan 1981. 65p. NTIS, PC A04/MF A01.

The fiber optic codec link was designed to meet the majority of data transmission requirements for both Underground Nuclear Weapon Effects Tests and High Explosive Tests at a substantial cost saving over current transmission methods including other multiplexing systems. The link is capable of transmitting a maximum of 92 channels of data over a fiber optic cable up to two kilometers in length. The bandwidth of the input data is switch selectable as 5kHz, 10kHz, or 20kHz. Fewer channels are available at higher bandwidths as lower bandwidth channels are paralleled to achieve higher bandwidth channels. Greater dynamic range is provided by the use of companding analog to digital converters which feature higher resolution for small signals.

58037 **(AD-A—109481/2) Fiber Optic CODEC Link (FOCOL). Volume 2 - manual. Final report, 1 November 1978-26 January 1981.** Naumann, W.; Liles, E.; Hogg, R.D. (Effects Technology, Inc., Santa Barbara, CA (USA)). 26 Jan 1981. 156p. NTIS, PC A08/MF A01.

The fiber optic codec link was designed to meet the majority of data transmission requirements for both Underground Nuclear Weapon Effects Tests and High Explosive Tests at a substantial cost saving over current transmission methods including other multiplexing systems. The link is capable of transmitting a maximum of 92 channels of data over a fiber optic cable up to two kilometers in length. The bandwidth of the input data is switch selectable as 5kHz, 10kHz, or 20kHz. Fewer channels are available at higher bandwidths as lower bandwith channels are paralleled to achieve higher bandwidth channels. Greater dynamic range is provided by the use of companding analog to digital converters which feature higher resolution for small signals. Volume 1 of the final report includes the technical discussion of the link program. Volume 2 of the final report is the manual for the link which provides a detailed description of the link and operating instructions.

58038 **(AD-A—109690/8) Places TV-track, ionosonde, and magnetometer operations. Final report, 1 April 1980-31 January 1981.** Chang, N.J.F. (SRI International, Menlo Park, CA (USA)). 1 Jun 1981. 16p. NTIS, PC A02/MF A01.

This report describes the TV tracking system, the slow-scan TV system, the KEL ionosonde, and the magnetometer that were operated in support of the PLACES experiment conducted at Eglin AFB, Florida in December 1980. A procedure for determining the proper launch time and aim point for both the beacon rockets and the probe rocket was developed after post-mission analysis of the first two releases. This procedure contributed to a successful beacon occultation for Event IRIS, and a successful probe penetration for Event JAN.

58039 **(AD-A—109717/9) Laboratory investigation of containment in underground nuclear tests. Final report, 17 December 1979-15 February 1981.** Cizek, J.C.; Florence, A.L. (SRI International, Menlo Park, CA (USA)). 15 Feb 1981. 90p. NTIS, PC A05/MF A01.

In support of the overall DNA program for stemming and containment of underground nuclear tests, existing laboratory techniques were further developed and applied to investigate the effects of a dynamically generated residual stress field on the containment of gases in exploded-device cavities. Laboratory experiments were performed on externally pressurized grout spheres containing a small explosive charge cast at the center. Immediately after detonation, water is pumped into the exploded cavity at a constant flow rate until the sphere is fractured to the outer surface. The fracture initiation pressures determined from the hydrofracture records are found to be substantially higher than those obtained in corresponding unexploded cavity experiments. This result provides a measure of the benefit to containment of the residual stress field created by the explosion. Relaxation of the residual stress field ws investigated by using a wide range of pumping rates, maintaining a constant cavity pressure for a time before hydrofracture, and by strain and stress gage measurements. An attempt was made to obtain hydrofracture records for uncoupled exploded cavities (air space around the charge). Although not successful, it was found that only a minor modification to the technique is required to provide the results.

58040 **(AD-A—109718/7) The relationship between material properties, residual stresses and cavity radius due to a nuclear explosion. Topical report, 26 September 1975-1 May 1976.** Rimer, N. (Systems, Science and Software, La Jolla, CA (USA)). 1 May 1976. 47p. (SSS-R—76-2907). NTIS, PC A03/MF A01.

The influence of material properties on the magnitude of the residual stresses around a nuclear cavity is examined. Particular attention in given to the effect on peak transverse residual stresses of parametrically varying material properties such as water content, percentage of air-filled voids, elastic properties, shear strength and depth of burial. The influence of these parametric variations on the final cavity radius is discussed. A correlation between peak residual stress and cavity radius is noted; a larger cavity radius implies a smaller residual stress.

58041 **(AD-A—109725/2) Analysis of jetting simulation experiments. Technical report.** Barthel, J.R.; Wiehe, J.W. (Systems, Science and Software, La Jolla, CA (USA)). 1 Jul 1981. 74p. (SSS-R—81-4898). NTIS, PC A04/MF A01.

This report describes calculational and analytical studies of high explosive jetting experiments designed to simulate energy injection into a nuclear line of sight. Numerous experiments were performed using identical spherical HE source embedded in wet sand. Damage was assessed by comparing the volume and depth of holes produced in aluminum target plates at the end of each pipe. An evacuated steel pipe, 19 mm o.d. and 0.3 mm thick, was the standard configuration. Many variations were used. Axially symmetric experiments produced some unexpected results, for example: use of a 2 mm jacket of lead around a standard pipe produced holes about twice as great in depth and volume as the average of the standard configurations; use of an air-filled pipe with wall thickness of 0.7 mm produced triple the standard hole size. Simplified calculation including the wall were performed for all three axisymmetric configurations in the frame of reference of a steady shock to provide guidance for the calculations of the actual configurations with a decaying shock. These produced the unexpected result that all three jet particulate mass and energy at equal rates as a steady state is approached. This result is explained by an adaptation of impulsive jetting theory. Configurations employing helical spiral asymmetries, 0.3 to 0.5 mm thick, also produced unexpected results. Spirals resting against the outer pipe wall resulted in essentially no change in target damage, whereas spirals resting against the inner wall virtually eliminated target damage.

58042 **(AD-A—109933/2) Final report.** Kardatzke, M.L.; Ellis, S.S.; Katzenstein, L.R.; Persky, M.E.; Smith, D.W. (Academy for Interscience Methodology, Chicago, IL (USA)). Dec 1980. 49p. (AIM—80-T-13). NTIS, PC A03/MF A01.

Chapters 1, 2 and 3 of this report describe technical effort directed towards the development of methods to be used in two-sided analyses. Chapter 3 describes analysis of weapon effectiveness against soft target data sets which verified the estimates provided by the National Strategic Force Mix Model, LINMIX. Chapter 4 discusses the revision of the National Strategic Force Mix Model, LINMIX. Chapter 5 and 6 are concerned with methods by which footprinting can be handled in LINMIX.

58043 **(AD-A—111419/8) Electromagnetic Pulse (EMP) handbook development for the Defense Nuclear Agency (DNA). Annual report 1 Oct 80-30 Sep 81.** Pierre, J.M. (Naval Research Lab., Washington, DC (USA)). 22 Feb 1982. 108p. (NRL-MR—4734). NTIS, PC A06/MF A01.

During FY 81, the Defense Nuclear Agency (DNA) initiated a program with the Naval Research Laboratory to provide technical and management support in the development of an electromagnetic pulse (EMP) handbook for ground based facilities. The focus of the handbook program during the first year was on the assessment of the data needs of the EMP user community and the adequacy of the existing data base. This report provides a summary of the activities, findings, and accomplishments during the past year in the EMP handbook development area.

58044 **(AD-A—995141/9) Operation Castle. Pacific Proving Grounds, spring of 1954. Report of Commander, Task Group 7.5.** (Joint Task Force Seven, Washington, DC (USA)). 1954. 57p. NTIS, PC A04/MF A01.

58045 **(SAND—82-0754) Radiation and propagation of short acoustical pulses from underground explosions.** Banister, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1982. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01. Order Number DE82020415.

Radiation and propagation of short acoustical pulses from underground nuclear explosions were analyzed. The cone of more intense radiation is defined by the ratio of sound speeds in the ground and air. The pressure history of the radiated pulse is a function of the vertical ground-motion history, the range, the burial depth, and the velocity of longitudinal seismic waves. The analysis of short-pulse propagation employed an N-wave model with and without enegy conservation. Short pulses with initial wave lengths less than 100 m are severely attenuated by the energy loss in shocks and viscous losses in the wave interior. The methods developed in this study should be useful for system analysis.

58046 **(UCID—19437) Introduction to nuclear test engineering.** O'Neal, W.C.; Paquette, D.L. (Lawrence Livermore National Lab., CA (USA)). 15 Jul 1982. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01. Order Number DE82020700.

The basic information in this report is from a vu-graph presentation prepared to acquaint new or prospective employees with the Nuclear Test Engineering Division (NTED). Additional information has been added here to enhance a reader's understanding when reviewing the material after hearing the presentation, or in lieu of attending a presentation.

58047 **(UCRL—53277) Look at nuclear artillery yield options using JANUS, a wargame simulation code.** Andre, C.G. (Lawrence Livermore National Lab., CA (USA)). 15 Jun 1982. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE82020454.

JANUS, a two-sided, interactive wargame simulation code, was used to explore how using each of several different yield options in a nuclear artillery shell might affect a tactical battlefield simulation. In a general sense, the results or outcomes of these simulations support the results or outcomes of previous studies. In these simulations the Red player knew of the anticipated nuclear capability of the Blue player. Neither side experienced a decisive win over the other, and both continued fighting and experienced losses that, under most historical circumstances, would have been termed unacceptable - that is, something else would have happened (the attack would have been called off). During play, each side had only fragmentary knowledge of the remaining resources on the other side - thus each side desired to continue fighting on the basis of known information. We found that the anticipated use of nuclear weapons by either side affects the character of a game significantly and that, if the employment of nuclear weapons is to have a decided effect on the progress and outcome of a battle, each side will have to have an adequate number of nuclear weapons. In almost all the simulations we ran using JANUS, enhanced radiation (ER) weapons were more effective than 1-kt fission weapons in imposing overall losses on Red. The typical visibility in the JANUS simulation limited each side's ability to acquire units deep into enemy territory and so the 10-kt fission weapon was not useful against enemy tanks that were not engaged in battle. (Troop safety constraints limited its use on tanks that were engaged in direct fire with the enemy).

58048 **(UCRL—87284) FOREX: a fiber-optics diagnostic system for study of materials at high temperatures and pressures.** Smith, D.E.; Roeske, F. (Lawrence Livermore National Lab., CA (USA)). Jul 1982. Contract W-7405-ENG-48. 8p. (CONF-820822—8). NTIS, PC A02/MF A01. Order Number DE82019437.

From 26. technical symposium and exhibition of the International Society for Optical Engineering; San Diego, CA, USA (21 Aug 1982).

We have successfully fielded a Fiber Optics Radiation Experiment system (FOREX) designed for measuring material properties at high temperatures and pressures in an underground nuclear test. The system collects light from radiating materials and transmits it through several hundred meters of optical fibers to a recording station consisting of a streak camera with film readout. The use of fiber optics provides a faster time response than can presently be obtained with equalized coaxial cables over comparable distances. Fibers also have significant cost and physical size advantages over coax cables. The streak camera achieves a much higher information density than an equivalent oscilloscope system, and it also serves as the light detector. The result is a wide bandwidth high capacity system that can be fielded at a relatively low cost in manpower, space, and materials. For this experiment, the streak camera had a 120 ns time window with a 1.2 ns time resolution. Dynamic range for the system was about 1000. Beam current statistical limitations were approximately 8% for a 0.3 ns wide data point at one decade above the threshold recording intensity.

58049 **(USGS-OFR—82-137) Geologic, geophysical, and in-situ stress investigations in the vicinity of the Dining Car chimney, Dining Car/Hybla Gold Drifts, Nevada Test Site.** Townsend, D.R.; Baldwin, M.J.; Carroll, R.D.; Ellis, W.L.; Magner, J.E. (Fenix and Scisson, Inc., Mercury, NV (USA); Geological Survey, Denver, CO (USA)). 1982. Contract AI08-76DP00474. 148p. NTIS, PC A07/MF A01. Order Number DE82012239.

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The Hybla Gold event, detonated on Nov. 1, 1977, was conducted in the U12e.20 drifts of the E-tunnel complex beneath the surface of Rainier Mesa at the Nevada Test Site. Though the proximity of the Hybla Gold working point to the chimney of the Dining Car event was important to the experiment, the observable geologic effects from Dining Car on the Hybla Gold site were minor. Overburden above the working point is approximately 385 m (1263 ft). The pre-Tertiary surface, probably quartzite, lies approximately 254 m (833 ft) below the working point. This report comprises three chapters detailing the geologic, geophysical, and in situ stress data gathered in the period January through June 1977, in the course of mining and drilling in the Hybla Gold/Dining Car region. These investigations confirm several observations reported previously for the Rainier event, i.e., a zone of microfailure observable in thin-section and in physical properties exists adjacent to the chimney. In addition, however, a number of investigations add new information to our understanding of effects near the detonation point. Shear waves were found to be highly diagnostic in the microcracked zone near the chimney as well as zones of failure at greater range not discernible as well as zones of failure at greater range not discernible by other techniques. Extensive in situ stress measurements made by the hydrofracture and overcore techniques indicate changes in the orientation and magnitude of the pre-Dining Car stress field. The hydrofracture technique further suggests pronounced gradients in minimum stress magnitudes over short distances at some locations in the postshot stress regime.

4503 Explosion Detection

58050 (AD-A—110080/9) Regional detection of decoupled explosions, yield estimation from surface waves, two-dimensional source effects, three-dimensional earthquake modeling and automated magnitude measures. Semiannual technical report. Bache, T.C.; Murphy, J.R.; Day, S.M.; Bennett, T.J.; Shkoller, B. (Systems, Science and Software, La Jolla, CA (USA)). Jul 1980. 146p. (SSS-R—80-4594). NTIS, PC A07/MF A01.

This semiannual technical report includes summaries of five separate technical reports. These are: (1) 'A Simulation Study of the Detectability of a 5.3 KT Decoupled Explosion at Regional Distances in the Eastern United States;' (2) 'Yield Estimation from Surface Wave Recordings of Underground Explosions - A Review;' (3) 'The Contribution of Two-Dimensional Source Effects to the Far-Field Seismic Signatures of Underground Nuclear Explosions;' (4) 'Three-Dimensional Earthquake Modeling Including Nonlinear Rupture Dynamics;' (5) 'Automated Magnitudes m sub b and M sub s.

58051 (AD-A—110181/5) The investigation of the combined use of microbarometric and seismic data to detect and identify infrasonic signals. Semi-annual report No. 1, 1 Apr-30 Sep 81. Sorrells, G.G. (Teledyne Geotech, Garland, TX (USA)). 30 Dec 1981. 23p. NTIS, PC A02/MF A01.

There is a need to acquire an infrasonics monitoring capability to supplement existing atmospheric nuclear test surveillance systems. A research program to investigate the combined use of a three-component seismograph and a microbarograph to supply the desired monitoring capability is currently underway. A temporary observatory consisting of a five-element microbarograph array and a three-component, long-period seismograph system has been established near McKinney, Texas, to acquire the experimental data necessary to perform the investigation. Preliminary analysis of the data indicates that the infrasonic signal-to-noise ratio will be greater at the output of a vertical seismograph than at the output of a microbarograph in a frequency range extending roughly from 0.005 Hz to 0.05 Hz during intervals of atmospheric turbulence.

58052 (AD-A—110183/1) Relative waveform inversion. Semi-annual technical report 1 Nov 1979-30 Apr 1980. Mellman, G.R.; Kaufman, S.K. (Sierra Geophysics, Inc., Redmond, WA (USA)). Nov 1981. 77p. (SGI-R—81-048). NTIS, PC A05/MF A01.

A relative waveform inversion method has been developed which determines models that correctly predict waveform changes in a set of observed seismograms. By modeling changes in waveforms rather than absolute waveforms, a number of relatively poorly determined quantities, such as receiver function and Q, may be eliminated from the problem and greater resolution of key model parameters obtained. The method has been applied to the estimation of overall amplitude, pP amplitude and pP delay time for a suite of seven presumed underground nuclear explosions in the Eastern Kazakh region. Events divide into two populations based on pP amplitude, with events having small pP amplitude possibly showing indications of azimuthal variation in pP. The existence of events with radically different pP amplitudes suggest that biases may exist in current relative yield estimation techniques, an effect which is corrected for in the relative waveform method.

58053 (AD-A—110184/9) The use of intermediate and long period seismic waves for discrimination and yield determination. Annual Report No. 2, 1 Oct 80-30 Sep 81. Pomeroy, P.W. (Rondout Associates, Inc., Stone Ridge, NY (USA)). 1 Nov 1981. 114p. NTIS, PC A06/MF A01.

This report deals with the following subjects: (1) The use of Lg to determine yield for U.S. explosions as recorded by WWSSN stations in the United States; (2) Analyses of seismic data from the HARZER nuclear explosion as recorded at the Catskill Seismic Array (CSA) in Stone Ridge, New York; (3) Seismic noise characteristics at the CSA; and (4) The calibration and response of the CSA.

58054 (BARC—1103) Long-period seismic system at Gauribidanur. Suryavanshi, M.P. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 19p. Dep. NTIS (US Sales Only),MF A01. Order Number DE82904591.

Portions of document are illegible.

This report describes the seismic long-period data acquisition system at Gauribidanur. The field electronics was designed to achieve a configuration of improved stability and dynamic range in the pass band of 0.025 to 0.1 Hz. Some typical records obtained by the system are shown. Surface wave magnitudes estimated at GBA are found to be in general agreement with those of international estimates.

58055 (FOA-C—20358-T1-Rev.) Internal seismological stations for monitoring a Comprehensive Test Ban Treaty. Dahlman, O.; Israelson, H. (Forsvarets Forskningsanstalt - FOA, Stockholm (Sweden)). Jun 1980. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903338.

Portions of document are illegible.

The possible use of internal seismological stations that might be established in the US and the USSR for the verification of a Comprehensive Test Ban on nuclear explosions are discussed. Attempts are made to assess various technical purposes that such internal stations might serve in relation to a global network of seismological stations. A description of American instrumentation developed for such stations is also presented. An extensive, non-technical summary is included.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 58087, 59087

58056 (AD-A—111632/6) Geophysical plasmas and atmospheric modeling. Final report. Hyman, E.; Apruzese, J.; Brecht, S.; Chao, W.; Chen, J. (Science Applications, Inc., McLean, VA (USA)). Jan 1982. 450p. (SAI—82-676-WA). NTIS, PC A19/MF A01.

The work performed on this contract encompasses a wide range of topics in space plasma physics and atmospheric modeling in support of the programs of the Geophysical and Plasma Dynamics Branch of the Naval Research Laboratory (NRL). Significant results were obtained in the following areas which will be discussed in succeeding sub-sections below: (A) solar wind-magnetospheric interaction using 2D and 3D MHD computer simulations, (B) investigations of the lower hybrid drift instability, (C) double layer modeling, (D) auroral electron acceleration, (E) ELF/VLF generation in the ionosphere, (F) high altitude nuclear effects, (G) evaluations of atmospheric cooling model, (H) ozone transport, (I) limitations on stratospheric dynamics, (J) general circulation model studies, and (K) collective particle acceleration.

58057 (AD-A—111640/9) Atmospheric pressure and velocity fluctuations near the auroral electrojet. Technical report. Luhmann, J.G. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 15 Jan 1982. 40p. NTIS, PC A03/MF A01.

The low frequency pressure and velocity perturbations caused by the temporally varying Lorentz force associated with auroral electrojet activity are modelled by calculating the disturbances generated by a two-dimensional, time-dependent current system in a gravitationally stratified, isothermal, windless atmosphere. These calculations provide information about the pattern of gravity waves around the hypothetical electrojet and give estimates of the magnitudes of near-field auroral disturbances in the middle atmosphere. It is suggested that the near-field vertical wind shears may be large enough to affect the development of air turbulence in the auroral zone.

58058 (DOE/ET/03425—22) Balance of the tropospheric ozone and its relation to stratospheric intrusions indicated by cosmogenic radionuclides. Technical progress report, November 1, 1981-June 30, 1982. Reiter, R.; Kanter, H.J.; Jaeger, H.; Munzert, K.H.; Sladkovic, R. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (Germany, F.R.). Inst. fuer Atmosphaerische Umweltforschung). Jul 1982. Contract AC02-76EV03425. 26p. NTIS, PC A03/MF A01. Order Number DE82019952.

The balance of the tropospheric ozone is studied with regard to sources and sinks. The influx of stratospheric ozone into the lower troposphere is determined by vertical profile measurements and fixed stations at three different levels. Presented are first results of the statistical analysis of the 12-year measuring series (1970 to 1981) of the cosmogenic radionuclide Be^7 used as tracer; the frequency distribution and annual variation of the Be^7 concentration are discussed. The power spectra of the Be^7 values for low frequencies ($\leqq$ 2 per year) are shown. The correlation of ozone with Be^7 is reinvestigated. The time variation of the concentration of the stratospheric aerosol after the eruption of Mt. St. Helens and other volcanoes, as detected by lidar, and their possible effect on the heat budget of the earth are studied. Possible sources of the mistery cloud, observed in early 1982, are shown.

58059 (PB—82-156613) One- and two-dimensional photochemical modeling of the chemical interactions in the middle atmosphere (0-120 km). Solomon, S. (National Center for Atmospheric Research, Boulder, CO (USA). Atmospheric Analysis and Prediction Div.). 1981. 282p. (NCAR/CT—62). NTIS, PC A13/MF A01.

Photochemical modeling studies of the middle atmosphere are described, with particular emphasis on the photochemistry of the nitrogen oxides, their production in the lower thermosphere, and possible transport to the stratosphere. A one-dimensional photochemical model which treated the troposphere and stratosphere has been extended to include the mesosphere and lower thermosphere. This model has been used to study the ion and neutral chemistry of charged particle precipitation events. The production of NO and OH by such events and their effects on atmospheric ozone in the stratosphere and mesosphere are described. A two-dimensional model has also been extended to treat the lower thermosphere and mesosphere, as well as the stratosphere and troposphere. Large amounts of NO are produced in the lower thermosphere, both by fast photoelectron impact on N2 during quiet times, and by auroral ionization. In a two-dimensional model, the NO produced can reach the stratosphere in large amounts near the pole during the polar night period. The effect of this large additional source of stratospheric NO from upper atmospheric phenomena on both stratospheric ozone and NO has been found to be substantial using presently accepted photochemistry.

58060 (PNL-SA—8633) PNL sections of draft WISPE report. Nickola, P.W. (Pacific Northwest Lab., Richland, WA (USA)). May 1980. Contract AC06-76RL01830. 83p. NTIS, PC A05/MF A01. Order Number DE82005800.

Observations and measurements of the meteorology of the southeastern United States during December 1979 in the vicinity of a power plant are presented. The temperature and humidity effects of the cooling tower plumes were investigated by tethered balloon flights. (ACR)

58061 January angular momentum balance in the OSU two-level atmospheric general circulation model. Kim, J.; Grady, W. (Climatic Research Institute and Department of Atmospheric Sciences, Oregon State University, Corvallis 97331). *Journal of the Atmospheric Sciences;* **39**: No. 5, 949-960(May 1982).

The atmospheric angular momentum balance is studied by analyzing the data during a simulated January of the Oregon State University two-level atmospheric general circulation model. Monthly zonal means of the Coriolis torques, the vertical transfer of relative angular momentum by penetrating convection, midlevel convection, background viscosity, pressure force and vertical motion, the meridional transfer of relative angular momentum by the standing zonal mean motion, standing eddies and transient motion, and the surface exchange of relative angular momentum by oceanic and continental friction and mountain torque are computed.

58062 Preliminary calculations of average storm duration and seasonal precipitation rates for the northeast sector of the United States. Thorp, J.M.; Scott, B.C. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **16**: No. 7, 1763-1774(1982). Contract AC06-76RL01830.

Regional and seasonal averages of storm duration and precipitation rates are needed as input variables in models aimed at describing precipitation processes relating to acid rain and other problems. Hourly precipitation data for 77 first order weather stations were used to calculate the summer and winter regional average storm duration and average precipitation rates over the northeastern United States. Average storm duration for summer (June-July-August), and winter (December-January-February) seasons considered periods of up to three dry hours in summer storms, and up to 6 dry hours in winter storms to be part of the same storm. Thus, each storm consisted of one or more precipitation periods. The average precipitation event rates for summer and winter storms were calculated. By considering storm duration on an hourly basis, the 3-h summer storm was found to contribute the greatest fraction to total summer precipitation. Similarly, the 26-h winter storm was found to contribute the greatest fraction to winter precipitation. The summer storms typically consisted of one rain event lasting about three hours with rain rates averaging 2.5 mmh^{-1}. The 25-h winter storm averaged about 3 precipitation periods (or rain bands). Each period lasted about seven hours and had an average precipitation rate of 1.0 mmh^{-1}.

58063 Modeling the tropospheric wind field over complex terrain. Holdeman, J.T. (Oak Ridge National Lab., TN). pp 340-342 of Second symposium on the composition of the nonurban troposphere. Boston, MA; American Meteorological Society (1982). Contract W-7405-ENG-26.

Researchers describe a model developed for wind fields over complex terrain at Oak Ridge National Laboratory for use with a particle-in-cell (PIC) model for pollutant transport, dispersion, interaction and removal which is also under development.

58064 Nonstationary nocturnal drainage flow model. Rao, K.S.; Snodgrass, H.F. (National Oceanic and Atmospheric Administration, Oak Ridge, TN). *Boundary-Layer Meteorology;* **20**: 309-320(1981).

The evolution and structure of the steady state of an idealized nocturnal drainage flow over a large uniformly-sloping surface are studied usig a nonstationary model with a height-dependent eddy diffusivity profile and a specified surface cooling rate. The predicted mean velocity and temperature profiles are compared with Prandtl's stationary analytical solutions based on the assumption of a constant eddy diffusivity in the drainage layer. The effects of important physical parameters, such as the slope angle, surface cooling, atmospheric stability, and surface roughness, on the steady drainage flow are investigated.

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58065 (ORNL-tr—4859A) **Recent results of dispersion experiments at emission heights of 50 and 100 m.** Geiss, H.; Vogt, K.J.; Ehrlich, H.G.; Polster, G. (Oak Ridge National Lab., TN (USA)). [nd]. Contract W-7405-ENG-26. Translation source information not available . 25p. NTIS, PC A02/MF A01. Order Number DE82021738.

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Models for the calculation of the environmental impact caused by emissions from conventional or nuclear plants are generally based on a Gaussian diffusion equation for the pollutant concentration near the ground. The necessary dispersion parameters, i.e., the standard deviations σ/sub y/ and σ/sub z/, can be empirically determined from dispersion experiments with exhaust air plumes containing tracers. In the Nuclear Research Facility Juelich 78 experiments at emission levels of 50 and 100 m have been carried out since 1970. The tests, which were carried out up to a distance of ca. 11 km, include all six diffusion categories. In order to better determine the dependency of the dispersion parameters on emission height, experiments involving the simultaneous emission of various tracer nuclides at both heights were also undertaken. The resulting dispersion parameters are representative for an area of average to great surface roughness. The dispersion parameters as well as the long-term dispersion factors calculated with them are compared with previous Juelich test results as well as with other parameter sets (Pasquill, Singer/Smith, McElroy/Pooler, Briggs). The influence of surface roughness and emission level in comparison with other systems is also discussed.

58066 (AD-A—109921/7) **Analysis of atmospheric ozone levels at commercial airplane cruise altitudes in winter and spring 1976-77. Technical paper.** Holdeman, J.D.; Nastrom, G.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Apr 1981. 18p. (NASA-TP—1807). NTIS, PC A02/MF A01.

It has been speculated that the ozone sickness experienced by some airline passengers and crew members during the winter and spring of 1976-77 were induced by abnormally high concentrations of ambient atmospheric ozone. To investigate the possibility that 1976-77 was anomalous, ozone measurements from balloons for up to 13 years and from Global Atmospheric Sampling Program (GASP) equipped aircraft for 3 years have been studied. The analyses show that the winter and spring seasons of 1976-77 were averaged statistically, and no evidence was found to suggest that there was more than a usual variation in the frequency that commercial airplanes encountered high ambient ozone concentrations.

58067 (AD-A—109922/5) **Determination of theoretical sampling efficiencies for aspirated particulate matter through the DRES large-volume sampler.** Miskew, I.; Mellsen, S.B. (Defence Research Establishment Suffield, Ralston, Alberta (Canada)). Apr 1981. 45p. NTIS, PC A03/MF A01.

Sampling and collection efficiencies are calculated for a large-volume air sampler under conditions of anisokinetic as well as isokinetic flow. A mathematical model developed to evaluate a tapered-tube sampling probe was modified to obtain results for the large-volume sampler, using various particle sizes and flow velocities. These results should facilitate the prediction or correction of sampling errors in field and laboratory experiments.

58068 (AD-A—110342/3) **Ozone measurements to 48km with chemiluminescent ozone detectors. Annual progress report.** Rosen, J.M.; Hofmann, D.J. (Wyoming Univ., Laramie (USA). Dept. of Physics and Astronomy). Jan 1982. 9p. (AP—70). NTIS, PC A02/MF A01.

An inflight ozone calibrator was tested both in a laboratory environmental chamber and on a balloon flight. The results demonstrate the need for an inflight calibrator and also indicate that there may be a serious and previously unobserved temperature sensitivity problem with one of the primary ozone detectors.

58069 (AD-A—110688/9) **Breadboard gas filter correlation spectrometer for atmospheric measurement of hydrazines and nitrogen dioxide. Final report Jan 77-Apr 79.** Dick, R. (Barringer Research Ltd., Rexdale, Ontario (Canada)). Oct 1981. 31p. (TR—79-281). NTIS, PC A03/MF A01.

This report describes the efforts to build a breadboard Gas Filter Correlation Spectrometer (GFSC) for the atmospheric measurement of hydrazines and nitrogen dioxide. The instrument was configured for use as an ambient monitor, with the possibility of conversion to a remote sensor by addition of a telescope. The final detection limits for the gases were: N2H4 = .3 ppm, UDHM = .23 ppm, MMH = .22 ppm, and N02 = 9 ppm.

58070 (AD-A—110835/6) **Stratospheric reactions of peroxynitric acid. Final report, 29 September 1978-31 December 1980.** Barker, J.R.; Trevor, P.L.; Kenley, R.A.; Chang, J.; Davenport, J.E. (SRI International, Menlo Park, CA (USA)). 23 Apr 1981. 151p. (SRI—7921-F). NTIS, PC A08/MF A01.

Both HO2 and NO2 play crucial roles in the chemistry of the upper atmosphere. For several years, these two species were thought to react via a radical disproportionation reaction, although it was suggested that a longer-lived complex could be formed according to reaction (1): HO2 + NO2 + M reversible reaction HOONO2 + M. The importance of reaction (1) has recently been verified by direct observation of HO2NO2 by Fourier transform infrared spectroscopy. Moreover, the rate of reaction (1) has been measured, and its reverse reaction (-1) has been studied. Also, RRKM theory has been applied to these data for reaction (-1) so that its rate can be reliably estimated as a function of both temperature and pressure. In another publication, the effect of HO2NO2 on tropospheric photochemical smog chemistry was discussed.

58071 (BARC—1128) **Ethylene in the atmosphere and its role in aerosol formation.** Subba Ramu, M.C.; Mohan Rao, A.M.; Muraleedharan, T.S.; Vohra, K.G. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiological Protection). 1981. 30p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82904596.

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Experiments investigating the mechanism of conversion of sulfur dioxide to sulfate aerosols in the presence of ethylene in the atmosphere are also discussed. The importance of ethylene in the atmosphere arises from the fact that its reactions in the atmosphere lead to the formation of hydroxyl and peroxy radicals which take part in rapid oxidation of gases like sulfur dioxide and oxides of nitrogen. The various intermediate reactions involved in the formation of the end products in the reactions of ethylene with other trace gases in the atmosphere are discussed. (PSB)

58072 (INIS-mf—7092, pp vp) **Environmental impacts of fossil-fuel and nuclear power plants.** Rusnak, M. (Ministerstvo Paliv a Energetiky CSSR, Prague). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

Large power plants burning fossil fuels generate emissions with a high content of sulphur dioxide and a content of noxious aerosols and radioisotopes whose radioactivity exceeds the limits set for nuclear power plants. The main problem of nuclear power plants is to secure radiation safety namely in case of an accident even though the probability of such an event is very small. The most complicated problems are related to the treatment of spent fuel, its transport, processing and storage.

58073 (JUEL—1704) **Investigation of the electron spin resonance spectra from matrix isolated.** Trainer, M. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie). Feb 1981. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82902420.

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The matrix isolation of C10 in a CO_2 matrix is investigated with the aim of providing a detection method for C10 in the stratosphere. Of main concern is the identification and interpretation of the so far unknown ESR-spectrum of matrix isolated C10. After trapping of C10 in a CO_2 matrix at 10 K a highly anisotropic ESR-spectrum is observed which can be attributed to C10. The shape and the g-values of the spectrum are characteristic for a $^2\pi$/sub 3/2/ groundstate. Some minor structure discernible on the spectrum can be related to C10 at different trapping sites. After annealing the sample at $T > 45$ K, the radical concentration diminishes and the g perpendicular peak splits into four peaks which correspond to the hyperfine splitting of C10. The values of the g and A tensors are determined by comparing the experimental spectrum with computer simulated spectra. In a simple crystal field model these values are compared with molecular parameters of C10 deduced from gas phase spectra.

58074 **(LA-UR—82-1363) Real-time monitoring of airborne beryllium, at OSHA limit levels, by time-resolved laser-induced breakdown spectroscopy.** Radziemski, L.J.; Loree, T.R.; Cremers, D.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENS-36. 16p. (CONF-820459—1). NTIS, PC A02/MF A01. Order Number DE82016072.

From Beryllium subwog meeting; Denver, CO, USA (19 Apr 1982).

Real-time detection of beryllium particulate is being investigated by the new technique of laser-induced breakdown spectroscopy. For beryllium detection we monitor the 313.1-nm feature of once ionized beryllium (Be II). Numerous publications describe the technique, our beryllium results, and other applications. Here we summarize the important points and describe our experiments with beryllium.

58075 **(NASA-CR—165264) Automated system for global atmospheric sampling using B-747 airliners. Final report.** Lew, K.Q.; Gustafsson, U.R.C.; Johnson, R.E. (United Air Lines, Inc., San Francisco, CA (USA)). Oct 1981. 31p. NTIS, PC A03/MF A01.

The global air sampling program utilizes commercial aircraft in scheduled service to measure atmospheric constituents. A fully automated system designed for the 747 aircraft is described. Airline operational constraints and data and control subsystems are treated. The overall program management, system monitoring, and data retrieval from four aircraft in global service is described.

58076 **(PB—82-146309) Investigation of the role of natural hydrocarbons in photochemical smog formation in California. Final report 19 Jun 79-18 Sep 80.** Winer, A.M.; Fitz, D.R.; Miller, P.R.; Stephens, E.R.; Burleson, F.R. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Mar 1981. 127p. NTIS, PC A07/MF A01.

Progress is described for a program designed to obtain data necessary for assessing the potential contribution of natural organics to the formation of photochemical air pollution in the California South Coast Air Basin (CSCAB). Needed data include knowledge of emission rates, ambient concentrations and oxidant- and aerosol-forming potential of biogenic hydrocarbons as well as estimates of vegetative biomass in the CSCAB. The following tasks have been carried out: Oxidant-precursor relationships were determined for near-ambient concentrations of a-pinene based on data obtained with a 40,000-liter dual-mode outdoor irradiation chamber. Initial measurements were made of the ambient concentrations of natural hydrocarbons emitted by relevant vegetative communities in areas free of anthropogenic emissions. Plant enclosure chambers and analytical methods were developed for measuring the emission factors of isoprene and monoterpenes from natural, ornamental and agricultural vegetation in the 'source region' of the CSCAB. Studies were made of the feasibility of applying remote imagery techniques (including LANDSAT, U-2 and low altitude photography) to the task of quantifying the extent and mass of vegetation in the 'source region' of the CSCAB.

58077 **(PB—82-151432) Hazard evaluation and technical assistance Report No. TA76-111, U.S. Secret Service vehicle garage, Washington, DC.** Ruhe, R.L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1977. 10p. (TA—76-111). NTIS, PC A02/MF A01.

Exposures to carbon-monoxide (630080) (CO) nitrogen dioxide (10102440) (NO2), and nitric oxide (10102439) were surveyed at the United States Secret Service (SIC-7525) Department of the Treasury, vehicle garage in Washington, D.C., on October 28, 1976. The survey was requested by the Chief of Administrative Operations Division, United States Secret Service, Department of the Treasury on behalf of an unspecified number of garage employees. Breath analyses for 7 workers revealed elevated carboxyhemoglobin (COHb) concentrations, but only 2 exceeded the OSHA standard of 50 parts per million, and these were found in heavy smokers. Nonsmokers did not exceed criteria, but did have elevated COHb. In air, CO concentrations were well within OSHA standards of 50 parts per million for an 8 hour time weighted average. No detectable concentrations of nitrogen dioxide or nitrous oxide were found. The author recommends that malfunctioning garage doors be repaired, outside air intake be kept clear of debris, automobiles be prohibited from parking at the outside air intake, local exhaust system be used when cars are serviced, and an inspection, test and evaluation of the ventilation system be performed to ensure its optimum operation.

58078 **(PB—82-157769) Hazard evaluation and technical assistance Report No. Ta 77-79, Department of Housing and Urban Development, Washington, DC.** Price, J.H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Feb 1978. 21p. (TA—77-79). NTIS, PC A02/MF A01.

Worker exposures to carbon monoxide (630080) (CO) were surveyed at the Housing and Urban Development (HUD) parking garage (SIC-7525) on October 25 to 27, 1977. The evaluation was requested by HUD on behalf of 3 parking attendants and about 1,000 carpool members. CO concentrations ranged from 20 to 56 parts per million (ppm). The recommended OSHA limit is 50ppm. Attendants were exposed to sufficient CO to produce carboxyhemoglobin concentrations as high as 7.3 percent as compared with NIOSH recommended criteria of 5 percent. The author concludes that a hazard exists due to CO on 1 day of exposure. He recommends an evaluation of the ventilation system, staggered departure times, increased capacity for the ventilation system, avoidance of needless idling of engines during periods of traffic congestion, employment of a traffic patrolman to direct traffic out of the garage, and the continued operation of the ventilation system until the garage is closed in the evening.

58079 **(PB—82-158312) Size selective samplers for particulate monitoring in California. Final report.** John, W.; Wall, S.; Wesolowski, J.J. (California Dept. of Health Services, Berkeley (USA). Air and Industrial Hygiene Lab.). Oct 1981. 38p. NTIS, PC A03/MF A01.

The sampling efficiency of the Size-Selective Hi-vol has been measured with monodisperse DOP particles. The cutpoint is 15 micrometers and is insensitive to flow rate. Particle deposits on the filter rate are 3% lower near the corners than in the center. Sampling a non-uniform aerosol cloud results in non-uniformity on the filter, but reduced by a factor of three. On the basis of these tests and particle bounce tests by the authors, it is concluded that this instrument is a satisfactory 'inhalable' particle sampler. The AIHL cyclone was modified to accept cassette-mounted membrane filters and retested. The pressure drop vs. flow rate curve shows the cyclone to operate in a single flow regime from 5 to 200 L/min. Using monodisperse oleic acid particles, the 50% cutpoints at 16.7, 24 and 55 L/min are found to be 3.5, 2.5 and 1.2 micrometer, respectively. The data at 55 L/min fit the same universal curve as that at lower flow rates. Deposits on the after filter were uniform to within 5%. The cyclone has been found to perform well with the new filter holder.

58080 **(PB—82-164369) Particle sampling and analysis in the California San Joaquin Valley. Final report Jul 78-Jul 80.** Heisler, S.L.; Baskett, R. (Environmental Research and Technology, Inc., Westlake Village, CA (USA)). Dec 1981. 277p. NTIS, PC A13/MF A01.

The California Central Valley experiences significant air pollution during certain times of the year. For some time, the origins of pollution have been debated. It is not certain how much of the pollution comes from transport, or how much is locally generated. As a part of a large investigation of these questions, an exploratory aerosol characterization program was conducted at the same time other air quality observations and tracer studies were undertaken. The results of the aerosol study indicate that the particulate matter sampled during short periods of the winter 1978 and summer and fall 1979 were dominated by soil dust, sulfate, nitrate and carbon. This was true of both the particles approximately less than 20 micrometers aerodynamic diameter, and approximately less than 2.5 micrometers aerodynamic diameter. Fine particles made up half or less of the material sampled. Sulfate concentrations and carbon were reasonably uniform through the months and locations sampled, but there was significantly more nitrate found in winter than in the summer. Some evidence for enrichment in ammonium was found in the aircraft data. The contributions of source to particle samples were estimated by the chemical element balance method. Blowing dust from cultivated and uncultivated land, unidentified carbon sources, and material from atmospheric chemical reactions (ammonium sulfate and nitrate) accounted for most of the material collected.

58081 **(PB—82-166133) National air quality, monitoring, and emissions trends report, 1977. Annual report.** Hunt, W.F. Jr; Frank, N.H.; Curran, T.C.; Faoro, R.; Cox, W. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Dec 1978. 78p. (EPA—450/2-78-052). NTIS, PC A05/MF A01.

This report presents national and regional trends in air quality through 1977 for total suspended particulate, sulfur dioxide, carbon monoxide, nitrogen dioxide and oxidants. The change in the number of people exposed to air quality levels above the National Ambient Air Quality Standards (NAAQS) is emphasized. Changes in air quality levels are discussed for the Nation, the Northeast Corridor, extending from Washington, D.C. to Boston and two selected metropolitan areas: Greater Cleveland and St. Louis. Air quality monitoring during 1977 is presented in terms of the number of reporting stations by pollutant and measurement method and their status with respect to the NAAQS. A unique feature of this report is the presentation of emission density maps, by county. Nationwide emissions for the period 1970-1977 are also presented.

58082 **(PB—82-166331) Development of methods for the determination of elemental phosphorus and phosphine in air. Final report.** Barrett, W.J.; Dillon, H.K. (Southern Research Inst., Birmingham, AL (USA)). Jan 1977. 110p. (SORI-EAS—77-060). NTIS, PC A06/MF A01.

Development of a solid sorbent sampling method for the measurement of elemental phosphorus vapor concentrations in air is described. The method is based on collection of phosphorus vapor on Tenax-GC, extraction with xylene, and determination by gas chromatography with a flame photometric detector. The overall method appears to meet all of the requirements established by NIOSH for industrial hygiene applications. Efforts to develop a solid sorbent sampling method for phosphine with a nonspectrophotometric analytical finish were not entirely successful. No solid sorbent that could collect phosphine efficiently and from which phosphine could be recovered by extraction or heating was found. The most nearly satisfactory method was based on collection of phosphine by reaction with mercuric cyanide on silica gel, with subsequent regeneration of phosphine by reduction with sodium borohydride and with gas chromatographic determination of the recovered phosphine. The recovery of phosphine was, however, less than quantitative and the storage stability of the collected sample was poor.

58083 **(PB—82-167206) Acidification of rain in the presence of SO2, H2O2, O3, and HNO3.** Overton, J.H. Jr; Durham, J.L. (Northrop Services, Inc., Research Triangle Park, NC (USA)). Jan 1982. 27p. NTIS, PC A03/MF A01.

The production of acid sulfate and the accumulation of acid nitrate are calculated for falling raindrops using a physico-chemical model that accounts for the mass transfer of SO2, H2O2, O3, HNO3, and CO2. The acidification is postulated to occur through the absorption of free gaseous HNO3 and the absorption and reaction of SO2, H2O2, and O3 to yield H2SO4. Investigated are the relative effectivness of H2O2(aq) and O3(aq) for oxidizing SO2(aq) to yield H(+1) and SO-2(-2), and the role of HNO3(aq) in acidifying raindrops and influencing SO4(-2) formation. Results indicate: that H2O2 is more effective than O3, HNO3 inhibits SO4(-2) formation due to O3 oxidation, and in all cases, HNO3 is important in acidifying rain.

58084 **(PB—82-167743) Complete testing of the NIOSH method for the determination of trace metals by atomic absorption spectrophotometry.** Marks, G.E.; Knutson, E.O. (IIT Research Inst., Chicago, IL (USA)). Sep 1975. 125p. NTIS, PC A06/MF A01.

A full collaborative test is conducted for evaluation of NIOSH Analytical Method P and CAM 173, 'General Procedure for Metals.' The method is applicable to the determination of 25 metals in airborne dusts and fumes by direct aspiration atomic absorption spectrophotometry. Aerosols of cadmium, chromium, cobalt, lead, and nickel are generated using aqueous metal nitrate solutions. Results show that the overall precision of the NIOSH method is 30% for lead, the best element. The method is found to understate the aerosol concentration by 9 to 23% for the five metals.

58085 **(PB—82-167750) Study of the cost effectiveness of stationary source, mobile source and transportation controls to improve air quality. Final report Sep 79-Nov 81.** Bellomo, S.J.; Mehra, J. (BKI Associates, Inc., McLean, VA (USA)). Nov 1981. 210p. NTIS, PC A10/MF A01.

This report presents the development and application of a sketch planning approach to conducting a cost effectiveness analysis of stationary source, mobile source and transportation controls to improve air quality. The methodology consists of five steps: adjust emission inventories, determine the initial list of controls, determine direct costs and emission reduction, determine other effects (user costs, socio-economic, other environment, etc.), and evaluate control strategies using a least cost model. The application of the methodology to the Philadelphia Air Quality Control Region for evaluating hydrocarbon emissions showed that although stationary source controls were more effective in reducing hydrocarbon emissions, most of the transporation controls were more cost effective even though their direct effect on reducing hydrocarbon emissions was not that great. Further testing in other metropolitan areas is needed to verify the generality of this conclusion.

58086 **(PB—82-169913) Methodology for estimating emissions from off-highway mobile sources for the RAPS program. Final report March-September 1974.** Hare, C.T. (Southwest Research Inst., San Antonio, TX (USA)). Oct 1974. 91p. NTIS, PC A05/MF A01.

Emissions, population, and usage data existing in the technical literature have been collected and organized for the following unregulated sources: outboard motors, snowmobiles, motorcycles, lawn and garden equipment, construction equipment, industrial equipment, and farm equipment. Methodologies for estimating emissions and fuel consumption on a county basis have been developed for the sources noted above. They have been demonstrated for counties in the St. Louis Metropolitan Air Quality Control Region (AQCR), and their strengths and weaknesses have been discussed. Methods have also been developed to apportion county emissions estimates to grid elements, but they have not been demonstrated. The exhaust constituents assessed include hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), particulate, aldehydes (RCHO), and oxides of sulfur (SOx). For outboard motors, neither particulate nor aldehyde data were available; but carbon dioxide (CO2) emissions were included.

58087 **(PB—82-172347) Chemically reacting plume experiments in the wind tunnel. Data report.** Builtjes, P.J.H. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Oct 1981. 23p. NTIS, PC A02/MF A01.

This report contains the data from the experiments of a chemically reacting plume in the wind tunnel at TNO-Apeldoorn. The experiments have been carried out in the PIA-wind tunnel of TNO-Apeldoorn. In the wind tunnel the atmospheric turbulent boundary layer above grassland (carpet roughness) has been simulated.

58088 (PB—82-177874) Review of the National Ambient Air Quality Standards for Particulate Matter: assessment of scientific and technical information. Staff paper (final). (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jan 1982. 274p. (EPA—450/5-82-001). NTIS, PC A12/MF A01.

This paper evaluates and interprets the available scientific and technical information that the EPA staff believes is most relevant to the review of primary (health) and secondary (welfare) National Ambient Air Quality Standards for Particulate Matter (PM) and presents staff recommendations on alternative approaches to revising the standards. The assessment is intended to bridge the gap between the scientific review in the EPA criteria document for particulate matter and sulfur oxides and the judgements required of the Administrator in setting ambient air quality standards for particulate matter. The major recommendations of the staff paper include the following: (1) that TSP be replaced by a new particle indicator that includes only those particles less than a nominal 10 micrometers (thoracic particles or PM(10)); (2) that the levels of both 24-hour and annual standards be revised; (3) that the statistical form of the standard should be changed; (4) consideration of a fine particle (less than 2.5 micrometers) secondary standard recognizing the advantages of combining any action with later decisions on acid deposition programs; and (5) consideration of secondary standards related to soiling and nuisance.

58089 (PB—82-179631) A method for determining helium in water. Report of investigations 1981. Holland, P.W. (Bureau of Mines, Amarillo, TX (USA). Helium Operations). Jan 1982. 23p. NTIS, PC A02/MF A01.

The Bureau of Mines has developed a method for determining helium in water for use in sampling and analyzing surface and subsurface waters for geochemical survey work. The accuracy of the analytical method is within plus or minus 10 percent for samples containing above 20 x 10 to the -8th power cc He (STP)/cc H2O. The minimum detectable helium-in-water concentration is calculated to be 2 x 10 to the -8th power cc He (STP)/cc water. Water samples are collected in 500-cc stainless steel cylinders. The dissolved gases are extracted into a cylinder of equal volume containing a known quantity of neon. The resulting gas mixture is subsequently analyzed for helium and neon-21 by mass spectrometry. The volume of helium in the sample is calculated from the mass spectrometric determination of the helium-to-neon-21 ratio, the known quantity of neon used, and the extraction efficiency of helium.

58090 (PB—82-184615) Health hazard evaluation report No. HHE-80-032-814, Magma Copper Company, San Manuel, Arizona. Apol, A.G.; Coye, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Feb 1981. 22p. (HHE—80-032-814). NTIS, PC A02/MF A01.

Personal breathing zone samples and medical evaluations of workers were performed at Magma Copper Company Smelter (SIC-3331) in San Manuel, Arizona on March 6, 1980 and from April 22 to April 23, 1980. The surveys were requested by a representative of the United Steel Workers, Local 937, to determine potential hazards to workers in the reverbatory furnace and converter departments of the smelter. Personal air samples contained cadmium (7440439), copper (7440508), and lead (7439921) concentrations below the OSHA standards of 100, 200, and 50 micrograms per cubic meter, respectively. Of the 75 samples collected for sulfur-dioxide (7446075), 14 exceeded the OSHA standard of 5 parts per million. All 92 workers examined had blood lead concentrations below 40 micrograms per 100 milliliters. Four arsenic (7440382) blood concentrations were above 100 micrograms per liter, but because of overall low arsenic concentrations in the work force these elevated values were not considered significant. Sulfur-dioxide exposure was responsible for complaints of respiratory irritation, chronic obstructive pulmonary disease, asthma and skin irritation. The authors conclude that a hazard exists at the company from exposure to sulfur-dioxide. The use of respirators during high exposures reduces hazards but does not eliminate the effects of repeated short term exposures. Recommendations include updating of the ventilation system, initiation of a respirator program, use of engineering controls to reduce airborne contamination, and worker hygiene improvements.

58091 (PB—82-188913) Dependence of nephelometer scattering coefficients on relative humidity: fronts, nocturnal disturbance, and wood smoke. Griffing, G.W. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). 1981. 36p. (EPA—600/3-82-006). NTIS, PC A03/MF A01.

The dependence of the nephelometer scattering coefficient of atmospheric air on the relative humidity at the RTP is discussed for four different meteorological examples. These examples feature (1) the passage of a low pressure system with thunderstorms, (2) the passage of a cold, dry front, (3) a nocturnal weather disturbance due to an unknown source, and (4) wood smoke aerosols from burning tree piles. Nephelometer scattering coefficient data were obtained by the use of two nephelometers. One nephelometer was operated at the ambient outside relative humidity and the other nephelometer at a different relative humidity. Using this operational mode of data acquisition, qualitative temporal information was deduced on the variations of aerosol size and number density as various meteorological parameters vary. The temporal trend of the visibility is also discussed for each example.

58092 (PB—82-190554) Determination of an empirically derived IP/TSP relationship. Final report Aug 80-Feb 81. Nelson, A.C. Jr.; Wijnberg, L. (PEDCo Environmental, Inc., Durham, NC (USA)). Apr 1982. 70p. NTIS, PC A04/MF A01.

The primary objective of this study was to provide researchers with statistical methodology for comparing data on inhalable particulate (IP) and on the IP/TSP ratios from various sites, predicting IP concentration as a function of total suspended particulate (TSP) concentration, and detecting potential outliers. Eleven sites were selected for study based on the completeness of both IP and TSP data. The frequency distributions of IP and TSP data indicate that the lognormal distribution provides a better approximation than the normal distribution. No attempt is made to derive numerical results for all the available IP/TSP data because the 11 sites are not a random selection from a population of sites. The data from these 11 sites were compared graphically by means of box plots showing the dispersion of the date, the median value, and specified percentiles. One of the major results was the study of relationships between the measurements of IP and TSP. Two forms of this relationship were compared, a simple linear one and a first order approximation to a model relating the logarithms of IP and TSP. The linear relationship was considered to be satisfactory for most applications; however, the second model form indicates that the simple ratio prediction (i.e., using a constant ratio of IP/TSP over all values of TSP) may not be appropriate for all TSP. Simple statistical test procedures are given for comparing the average ratios at two or more sites (or for two or more years at a single test site), detecting outlying observations, and for selecting IP monitoring sites based on available TSP data and a proposed standard for IP.

58093 (RR—614.71) Sulfur in the air in the capital (Helsinki) metropolitan area: ITASAT-project. Final report. Wallin, M.; Lumme, E.; Hietamaeki, M.; Rantakrans, E. (Finnish Meteorological Inst., Helsinki). 1981. 86p. (In Finnish). NTIS, PC A05/MF A01.

Methods for regionally producing and processing information about air quality, air protection measures, and determining alternative examples for air protection solutions are assessed. The sulfur dioxide content of air is predicted. The effects of various air protection measures and their cost (flue gas desulfurization, use of low sulfur heavy fuel oil) are compared.

58094 (UCRL—87829) Modeling of dispersion of heavy gases. Knox, J.B. (Lawrence Livermore National Lab., CA (USA)). Jul 1982. Contract W-7405-ENG-48. 10p. (CONF-820936—1). NTIS, PC A02/MF A01. Order Number DE82019110.

From 13. international technical meeting on air pollution modeling and its application; Toulon, France (14 Sep 1982).

The phenomenology and/or the evolution of a heavy gas spill are considered from the early times of release to when it is diluted below a prescribed level of toxicity or lower flamability limit (LFL). To the extent the processes contributing to this phenomenology are known, they are described. From this discussion, salient processes emerge whose quantification leads to the structuring of models for heavy gas dispersion. Matters dealt with in this executive summary will be covered in more detail in the full presentation.

58095 A simple automatic variable flow controller. Wolf, I.; Carpenter, R.L. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Journal of the Air Pollution Control Association;* **32**: No. 7, 744-746(Jul 1982).

A simple system is reported on for flow control, using standard components, that operates in the 20 to 70 ACFM flow rate range (0.4 to 1.4 m^3/min).The method is suitable for use in laboratory and field environments or for sampling exhaust gases from coal combustors. In source sampling tests, this system has successfully operated high volume filters at 26.9 ACFM (0.55 m^3/min) and a high volume cascade impactor at 21 ACFM (0.43 m^3/min). (JMT)

58096 Investigation of accident-generated aerosols: releases from free fall spills. Sutter, S.L.; Johnston, J.W.; Mishima, J. (Pacific Northwest Lab., Richland, WA). *American Industrial Hygiene Association Journal;* **43**: No. 7, 540-543(Jul 1982).

Saftey assessments and environmental impact statements for facilities require an estimation of airborne releases. Aerosols generated by accidents are being investigated to develop the source terms for these releases. The lower boundry accidental release event would be a free fall spill of powders or liquids in static air. Experiments measured the mass airborne and particle size distribution of these aerosols as a function of source size and spill height. Spill height and source size were significant in releases of both powders and liquids. Releases can be estimated using the relationship of source quantity and spill height. If definitive information is not available, the weight % of source initially airborne from a spill in static air can be estimated as 0.12% for powder and an order of magnitude lower for liquid. Powder median aerodynamic equivalent diameters ranged from 6 to 26.5 μm; liquids 4.1 to 34 m. All of the spills produced a significant fraction of respirable particles 10μm and less.

58097 Analysis of Burro series 40-m³ LNG spill experiments. Koopman, R.P.; Cederwall, R.T.; Ermak, D.L.; Goldwire, H.C. Jr.; Hogan, W.J.; McClure, J.W.; McRae, T.G.; Morgan, D.L.; Rodean, H.C.; Shinn, J.H. (Lawrence Livermore National Lab., CA). *Journal of Hazardous Materials;* **6**: No. 1-2, 43-83(Jul 1982).

A series of nine field experiments (Burro series) were conducted to determine the transport and dispersion of vapor from spills of liquified natural gas (LNG) on water. The principal conclusions are summarized as follows: The turbulent processes in the lower atmospheric boundary layer dominated the transport and dispersion of gas for all experiments except Burro 8. Burro 8 was conducted under very low wind-speed conditions, and the gravity flow of the cold gas displaced the atmospheric flow, causing the wind speed within the cloud to drop essentially to zero. This has profound implications for hazard prediction from large accidental spills. High-frequency (3-5 Hz) gas-concentration measurements indicate that peak concentrations within the flammable limits are common with 10-s-average concentrations above 1%. This implies a larger flammable extent than averaged data or calculations would indicate. Differential boiloff of LNG was observed with resultant enrichment of ethane and propane in the cloud at later times. This ethane-enriched region propagates downwind and represents an additional hazard since it is more easily detonated than the methane-rich region. Energetic rapid phase transition (RPT) explosions, though not expected, did occur under at least two different circumstances during the Burro 6 and 9 tests. These explosions were large enough to damage the facility and raise questions about the coupling of the RPT-produced shock wave into the ethane-rich region of the cloud.

58098 A comparison of dense gas dispersion model simulations with Burro series LNG spill test results. Ermak, D.L; Chan, S.T.; Morgan, D.L.; Morris, L.K. (Lawrence Livermore National Lab., CA). *Journal of Hazardous Materials;* **6**: No. 1-2, 129-160(Jul 1982). Contract W-7405-ENG-48.

The predictions from three vapor dispersion models for cold dense gas releases are compared with the results from several 40 m³ LNG spill experiments conducted at China Lake, California, in 1980. The models vary considerably in the degree to which they approximate important physical phenomena and include restricting assumptions. The simplest model (GD), a modified Gaussian plume model, predicted a vapor cloud that was always too high and too narrow by a factor of 1.5 to 3. The second model (SLAB), a layer-averaged conservation equation model with one independent spatial variable (downwind distance), generally predicted the maximum distance to the lower flammability limit (LFL) and cloud width quite well. SLAB assumes the vertical concentration distribution is nearly uniform so that the vertical concentration gradient ($\partial c/\partial z$) is essentially zero from the ground up through most of the cloud and then very steep at the top of the cloud. This was generally not the case in these experiments, especially in the high wind speed tests, where the vertical concentration gradient was found to be more gradual throughout the cloud. The final model (FEM3) is a fully three-dimensional conservation equation model that generally predicted the concentration distribution in time and space rather well. A particular achievement of this model was the prediction of a bifurcated cloud structure observed in one experiment conducted with a low ambient wind speed. Both the SLAB and the FEM3 models accurately predicted the length of time required for the cloud to disperse to a level below the LFL, even in the low wind speed test where the vapor cloud lingered over the source region for a considerable length of time after LNG spill was terminated.

58099 Predictions for particle deposition to vegetative canopies. Slinn, W.G.N. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **16**: No. 7, 1785-1794(1982).

A theoretical framework is presented for the analysis of particle dry deposition to vegetation. This framework is similar to the one used for the analysis of momentum in a vegetative canopy. In both cases, numerical integrations could be performed, but here approximate analytical solutions are sought. First, the case of momentum is re-examined, and it is suggested that the momentum source (-cp/cx) can be important in some cases. An approximate solution to the equation describing the air concentration of particles is then found, using similar approximations found to be reasonable for momentum. The result is illustrated for different collection efficiencies. C/sub d/ E, and then a specific, particle-size-dependent E is proposed based on windtunnel data obtained by Chamberlain. The results suggest that dry deposition velocities for 0.1-2.0 μm particles are typically about an order-of-magnitude smaller than values currently used in many air-quality models.

58100 Mechanistic analysis of precipitation scavenging using a one-dimensional, time-variant model. Hales, J. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **16**: No. 7, 1775-1783(1982).

A one-dimensional, time-variant model of a storm system is presented. The model is coded in modular form, and as a consequence it contains a great deal of flexibility for general interpretive use. Besides describing cloud and precipitation processes, the model possesses the capability to predict the precipitation scavenging of both reactive and nonreactive pollutants. Example computations are presented to illustrate the code's application for scavenging analysis. This example is based upon an orographic rain storm, and utilizes highly parameterized descriptions of cloud and precipitation phenomena. The primary pollutants of interest are SO_2 and sulfate. Sulfate aerosol is assumed to be scavenged by a nucleation mechanism, while SO_2 scavenging proceeds via the aqueous-phase reaction $SO_2+O_3 \rightarrow SO^{2-}{}_4$. Sulfate concentrations and deposition patterns obtained via these example calculations are not set forth as definitive characterizations of the scavenging process. They do, however, reflect some of the behavior commonly exhibited by real storm systems. More detailed application of this basic model is suggested for use in the future analysis of wet-deposition phenomena.

58101 Trace metals in atmospheric deposition: a review and assessment. Galloway, J.N. (Univ. of Virginia, Charlottesville); Thornton, J.D.; Norton, S.A.; Volchok, H.L.; McLean, R.A.N. *Atmospheric Environment;* **16**: No. 7, 1677-1700(1982).

Information on nineteen metals in atmospheric deposition potentially toxic to humans and other organisms was evaluated to conclude if metal concentrations are increasing in atmospheric deposition and if these concentrations threaten human or organism health. On the basis of rates of emission, atmospheric concentrations, and known temporal trends in deposition, Ag, Cd, Cu, Pb, Sb, Se, and Zn can be expected to show the greatest increases due to human activity with little or no increases expected for Co, Mn, Ni and Tl. The limited data available supported these expectations. In some cases, dry fallout was found to be significant relative to wet deposition. Of the metals studied only As, Hg, Se and possibly Cd are in the vapor phase in the atmosphere. Relative to the impact of these increased concentrations, Hg and Pb are now being deposited in some areas at levels toxic to humans and Cd, Cu, Hg, Pb and Zn at levels toxic to other organisms

58102 **Wet deposition variability as observed by MAP3S.** Wilson, J.W.; Mohnen, V.A.; Kadlecek, J.A. (State Univ. of New York, Albany). *Atmospheric Environment;* **16**: No. 7, 1667-1676(1982).

MAP3S data for 1977-1979 are utilized to examine temporal, spatial and directional variability of wet deposition of the dominant ions in precipitation for selected sites in the northeastern United States. Linear regression analysis applied to 3-y cumulative totals is found to be applicable and provide a reasonable wet deposition predictive capability. Trajectory analysis is also applied to the data set for two stations to determine the percentage of total wet deposition associated with various approach sectors. Spatial variability in wet deposition is examined by normalizing deposition totals. No step gradients in the normalized wet deposition of pollutant-related ions were found throughout the area of study.

58103 **Trajectory analysis of MAP3S precipitation chemistry data at Ithaca, N.Y.** Henderson, R.G.; Weingartner, K. (Mitre Corp., McLean, VA). *Atmospheric Environment;* **16**: No. 7, 1657-1665(1982).

Trajectory analyses have been performed for precipitation events collected by the MAP3S station at Ithaca, N.Y. over the period October 1977 to October 1979. The analyses have shown a clear seasonal dependence of the acidity due to precipitation events associated with air mass movement. During the summer, when biological activity is high, most of the $NH^+{}_4$ and SO_4^{2-} deposited by precipitation are carried by the same air masses thus reducing the acidity of the precipitation event. Most of the acidity on a per event basis during the summer is associated with air masses which have traveled over large NO/sub x/ sources to the east. When biological activity is low, however, most of the acidity on a per event basis is associated with air masses which have travelled over large SO_2 sources to the south west.

58104 **Variation in chemical wet deposition with meteorological conditions.** Raynor, G.S.; Hayes, J.V. (Brookhaven National Lab., Upton, NY). *Atmospheric Environment;* **16**: No. 7, 1647-1656(1982).

Analysis of hourly sequential precipitation samples collected at Brookhaven National Laboratory over a 4-y period shows systematic relationships between amounts of chemicals deposited in precipitation and meteorological conditions. Samples were taken by an automatic, sequential sampler and measured for pH, conductivity and the concentrations of major ions. Concurrent measurements and observations were made of the synoptic situation, precipitation type and rate, wind speed and direction, and temperature. Deposition per unit area was computed for subsets of the data classified by meteorological and time parameters. Results demonstrate that precipitation amount alone is not an adequate predictor of chemical wet deposition because of the variability of concentration in precipitation which is a complex function of emission rates and atmospheric processes. Results, however, document those conditions under which most material is deposited and those circumstances in which deposition occurs at the greatest rate. When classified by season, hydrogen and sulfate ion deposition are greatest in the summer when precipitation is lowest and least in the winter when precipitation is greatest. Nitrogen in both nitrate and ammonium has a similar but less extreme pattern. By synoptic type, all chemicals are deposited most heavily in warm front precipitation but the fraction of hydrogen and sulfate deposited in cold front and squall line hours is greater than the fraction of precipitation. All chemicals are deposited most heavily in steady rain when examined by precipitation type but thundershowers deposit chemicals of anthropogenic origin in amounts disproportionate to precipitation amounts. Results are also presented from data classified by other parameters.

58105 **The MAP3S/RAINE precipitation chemistry network: statistical overview for the period 1976-1980.** (MAP3S/RAINE Research Community). *Atmospheric Environment;* **16**: No. 7, 1603-1631(1982).

This paper presents a basic statistical summary of the initial 3 1/2 year operating period of the MAP3S/RAINE precipitation chemistry network. The overview considers statistical features of the precipitation event data base, including temporal and variable-pair behavior and spatial (site-to-site) relationships. Seasonal variations in concentrations of the species total sulfur, SO_2, free hydrogen ion and NH_4^+ are easily identifiable from both event and monthly average time trend analyses. Species-pair correlations are generally strong and positive among the major ionic species total S, nitrate, free hydrogen and ammonium; variations from this trend at individual sites can be related to geographical location. Though reasonable coherency is exhibited in site-to-site correlation analyses, the questions of proper averaging time and network density make interpretation of spatial statistics difficult. It is anticipated that this summary will be a directly useful resource for wet-deposition assessment in the northeastern United States, and should compose a convenient starting point for more detailed analysis by the extended research community.

58106 **Theoretical estimates of the scavenging coefficient for soluble aerosol particles as a function of precipitation type, rate and altitude.** Scott, B.C. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **16**: No. 7, 1753-1762(1982). Contract AC06-76RL01830.

Wet removal coefficients are derived for rain and snow. The parameterizations are intended for regional or mesoscale models and are meant to apply for soluble particles that are incorporated into the cloud liquid water via nucleation. The wet removal coefficients are shown to be a function of precipitation rate which, in turn, is a function of altitude. This altitude dependency is determined from a series of transcendental equations and is related to height of the freezing level and form of precipitation at the ground (i.e. rain vs snow).

58107 **Predictions of in-cloud conversion rates of SO_2 to SO_4 based upon a simple chemical and kinematic storm model.** Scott, B.C. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **16**: No. 7, 1735-1752(1982). Contract AC06-76RL01830.

A simple chemical model has been combined with a kinematic storm model in order to present a methodology for computing the percentage of total wet-deposited sulfate that is derived from an in-cloud conversion process. The overall model assumes that the sulfate deposited in precipitation originates from either nucleation of pre-existing particles or from aqueous-phase conversion of SO_2 occurring within the precipitating cloud. The model has been run for two idealized situations representing the average winter and summer storm conditions in the northeastern United States. Seasonally averaged storm conditions and pollutant concentrations for the eastern U.S. have been used to define input conditions for sulfur inflow and storm simulation, and 55-70% of the sulfate in the summer storm simulation. The storm model predicts time available for conversion within the condensed cloud water and enables conversion rates to be computed. In both the winter and summer storm simulations, SO_2 in-cloud conversion rates were found to be between 5 and 20% h^{-1}. Based upon calculations of sulfate removal efficiencies, over 80% of the ingested sulfate aerosol was removed from the simulated summer and winter storms. The storm simulations also predicted a high level source of sulfate which was attributable to in-cloud conversion of SO_2 at levels where removal by precipitation was neglibible. These findings should not be generalized to include any winter or summer storms at any location. To do so would require many simulations with data relating particular pollutant surface deposition patterns to specific inflow concentrations of pollutants. Such data are not available.

58108 In-cloud and below-cloud scavenging of nitric acid vapor. Levine, S.Z.; Schwartz, S.E. (Brookhaven National Lab., Upton, NY). *Atmospheric Environment;* **16**: No. 7, 1725-1734(1982). Contract AC02-76CH00016.

Scavenging coefficients,Λ, for the removal of HNO_3 vapor from the atmosphere by both cloud and rain drops have been calculated for assumed models of drop-size distribution. For cumulus clouds a value of $0.2s^{-1}$ is estimated for Λ. Evaluation of rainfall washout coefficients gives values of Λ ranging from $1.3x10^{-5}$ to $1.5x10^{-3}s^{-1}$, depending upon the rainfall rate, upon the drop-size distribution function employed, and, strongly upon the lower limit of the raindrop size employed in the calculations. The concentration of soluble gas dissolved within a falling drop per unit fall distance is found to be a function of drop size, with the smaller drops accumulating the greater concentration. The long-term average rate of heterogeneous removal of HNO_3 is estimated in the range 1-$8x10^{-6}s^{-1}$, representing comparable contributions from dry deposition and rainfall scavenging.

58109 SMICK - A scavenging model incorporating chemical kinetics. Drewes, D.R.; Hales, J.M. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **16**: No. 7, 1717-1724(1982).

A scavenging model has been developed as an advanced tool for assessing the wet deposition of reactive gases and aerosols from point-source plumes. The model describes both the microscopic and macroscopic aspects of the plume-rain interaction, and predicts the concentrations of pollutant in rain at ground-level points below the plume. Microscopic interactions treated by the model include simultaneous mass transfer and chemical reaction, both outside and within the falling raindrops. Reversibility is incorporated within the mass-transfer description, thus allowing a realistic treatment of gas scavenging. Application of the model to the washout of SO_2 from power plant plumes, both with and without the assumption of chemical reaction within droplets, is described. These results indicate that sulfate levels found in rainwater below power-plant plumes are not adequately explained by traditional aqueous-phase conversion mechanisms involving oxidation of SO_2 by oxygen, at least when such conversion is limited to the below-cloud region. The model has been documented in user's-manual form, and is suggested for use in the general assessment of deposition impacts of pollution sources such as fossil power plants.

58110 SO_2 content in precipitation and its relationship with surface concentrations of SO_2 in the air. Pena, J.A.; de Pena, R.G.; Bowersox, V.C.; Takacs, J.F. (Pennsylvania State Univ., University Park). *Atmospheric Environment;* **16**: No. 7, 1711-1715(1982).

As part of the MAP3S program, SO_2 atmospheric concentration has been monitored continuously since October 1978 and precipitation samples have been collected during the same period with two different types of collectors; the Battelle and Aerochem models. The data provided by both collectors, together with the temperature and the SO_2 data have been analyzed in order to establish the degree of correlation between the sulfur dioxide contained in the rain samples and the SO_2 air concentration, and also the contribution of the dissolved SO_2 to the acidity of the precipitation. The results can be summarized as follows: (1) the S/sub IV/ content in the rain samples collected with the Battelle collector is close to the equilibrium values corresponding to the surface SO_2 concentration in the air. The values found in the samples collected with the Aerochem are lower. These results suggest that equilibrium between the gas and liquid phases is rapidly established in the falling rain and that the equilibrium values are preserved when the samples are adequately collected and stored. (2) The contribution to the total free acidity by S/sub IV/ reaches up to 13% in the winter and goes down to practically zero in the summer. (3) The $SO^{2-}{}_4$ content in the rain is negatively correlated with the SO_2 concentration in air at the surface.

58111 Factors influencing trace metal, sulfate and hydrogen ion concentrations in rain. Lindberg, S.E. (Oak Ridge National Lab., TN). *Atmospheric Environment;* **16**: No. 7, 1701-1709(1982). Contract W-7405-ENG-26.

Precipitation collected as wetfall-only and primarily on an event basis at a site in the Tennessee Valley is a dilute sulfuric acid solution containing trace metals whose concentrations exhibit log normal distributions. The concentrations of H^+, $SO_4{}^{2-}$, Pb, Mn and Zn exhibit maxima in the warmer months in response to synoptic meteorologic conditions. These conditions result in elevated air concentrations during air stagnation and in generally lower rainfall amounts per event and hence less dilution of the scavenged rainfall amount, the rainfall parameter exerting the strongest influence on cencentrations. Concentrations are negatively correlated with rainfall duration and intensity to a lesser extent. The relationship between concentration and rainfall amount is approximately a 0.6-power relationship. Calculated scavenging ratios generally increase with increasing atmospheric particle mass-median diameter of each element and are on the order of 100 for Pb, 1000 for $SO^{2-}{}_4$ and 5000 for Cd and Mn.

58112 Time- and space-resolved measurements of particulate formation during premixed constant volume combustion. Flower, W.L.; Dyer, T.M. (Sandia Lab, Livermore, Calif). pp 26p, Paper No. CSS/CI-80-01 of Combustion Institute, Central States Section, spring meeting, 1980. Baton Rouge, LA; Combustion Institute (1980).

From Spring meeting of the Combustion Institute Central States section; Baton Rouge, LA, USA (24 Mar 1980).

Experiments to characterize and measure soot particulate formation processes are being conducted in a constant volume combustion bomb. The objective of this work is to provide insight into the origins of soot and its behavior in combustion engines. These experiments with rich, homogeneous mixtures focus on the particulate formation and agglomeration processes, because the experimental conditions of a combustion bomb most accurately simulate the early phases of combustion in an engine. 19 refs.

58113 National research and development program: environmental air. Summary. Final report, 1975-1978. Brussels, Belgium; Service de la Programmation de la Politique Scientifique (1979). 40p. (In French). NTIS, PC A03/MF A01.

The air quality in and around Gent, Belgium, was studied. Results presented cover pollution transport, epidemiology (pulmonary and respiratory diseases), and measures of interior versus exterior contaminant concentrations. Modeling software for meteorology, emissions monitoring, methodology of environment monitoring, and the economic implications of the fight against air pollution are also discussed.

58114 (PB—82-156696) Chemical, physical and biological assay of welding fume. Part II: implications of positive mutagenic tests. Stern, R.M. (Svejsecentralen, Glostrup (Denmark)). [nd]. 36p. NTIS, PC A03/MF A01.

The consequences of positive mutagenic test results on stainless steel welding fume are discussed, and the need for identification of the active material pointed out. Detailed chemical analysis indicates that hexavalent chromium is one of the active mutagens. The possible significance of the large variation in water soluble and water insoluble Cr(VI) content of MIG and MMA fume is discussed in terms of variation in human carcinogenicity of these two types of Cr(VI) compounds. Arguments for the requirement of establishing strategies to deal with positive results before tests are carried out are presented.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 56323, 56376, 56384, 56386, 56721, 56943, 58058, 58072, 58096, 58132, 58134, 58166, 58232

58115 (AD-A—104802) Atmospheric ^{222}Rn measurements at San Nicolas island during 1980. Larson, R.E.; Jeck, R.K. (Naval Research Lab., Washington, DC (USA)). Oct 1981. 10p. NTIS, PC A02/MF A01.

Radon concentration in the near surface air at San Nicolas Island, California, was measured. Unreported results for January and July 1980 are emphasized. For six of eight days during the January session the measured radon concentration was greater than 40 picocuries/cubic m corresponding to a continental air mass. Only the first day involved a maritime air mass with radon concentration less than about 6 picocuries/cubic m. In contrast to all the previous sessions, maritime, air dominated the ten day session in July 1980, with radon concentrations generally less than about 5 picocuries/cubic m.

58116 (INIS-mf—7092, pp vp) **Evaluation of radiation hygiene impacts of A-1 nuclear power plant operation.** Carach, J. (Krajska Hygienicka Stanica, Bratislava (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The environmental impact is evaluated of the operation of the Bohunice A-1 nuclear power plant. The permissible limits are given of the amount of radioactive exhausts and liquid radioactive wastes for the period 1973 to 1977. The results are given of the analysis of the strontium 90 and cesium 137 content in radioactive fallout, the soil, wheat, lucerne, in the waste discharge into the Dudvah river and the content of strontium 90 in mil, The results show that the current state of contamination of the biosphere by the operation of nuclear power plants is not a matter to cause concern. The programme of environmental control in the area of the nuclear power plant is described.

58117 **(ISH—9) Comparison of the radiation exposure by radioactive emissions of conventional power plants and of nuclear power plants.** Bretschneider, J. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Sep 1981. 51p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

The emission values of radioacitve matter of coal- and nuclear power plants are based on measurements. As to the nuclear power plants mean values of the emissions are determined by means of the data of several years of operation; the emission values for the hard coal power plants are based on measurements effected in the Staudinger power plant in 1979/1980. The calculation of the radiation exposures is realized with the models and parameters of the BMI-(Federal Ministry of the Interior) computation base. Beside the dose factors of ICRP-2 the results are calculated in parallel with the dose factors according to ICRP-30. The calculated radiation exposure as a total body dose rate or effective dose rate ranges at the maximum plotted point between 0.1 and 1 mrem/a for the generation of one giga-watt-year of potential energy. This is good for LWRs as well as for the stone coal power plant. The maximum dose rates for single critical organs or tissues are below 10 mrem/a. In coal power plants the bone and the bone surface are most-exposed, while in nuclear power plants the maximum dose rates are to be expected in the thyroid gland and in the fatty tissue.

58118 **(NUREG—0837-Vol.1-No.4) NRC TLD direct radiation-monitoring network. Progress report, October-December 1981.** Costello, F.; Thompson, T.; Cohen, L. (Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). Jun 1982. 67p. GPO $7.00.

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This report is part of a continuous series providing data from the NRC's Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network. This report presents data for the fourth quarter of 1981. The report presents the radiation exposure levels measured in the vicinities of NRC-licensed facilities throughout the country and includes facilities under construction, as well as those which are in operation. The TLD data are reported in terms of milliroentgens and include exposures received while the dosimeters were in transit, as well as exposures received in the field. A control TLD, labeled CTL TLD in the reports, accompanied the TLD shipment during transit and was stored in a low background area while the other TLDs were in the field. The control TLD exposure is given for the purpose of comparison and as an indication of transit exposure to the field TLDs. Station numbers which are not included represent stations which have been deleted, stations for which the TLD was lost during the quarter, or stations for which the TLD is damaged. Occasionally, a control TLD is not included because it was also lost or damaged. Two sets of data are presented for each site. The first set includes the TLD station number, its direction and distance from the site, the integrated quarterly exposure for the period, and the daily exposure rate. The second set of data summarizes in tabular form the average quarterly exposure measured at three ranges of distances from the facility.

58119 **(RHO-LD—163) Environmental surveillance. Annual report for calendar year 1980.** Wheeler, R.E.; Conklin, A.W.; Elder, R.E.; Osborne, W.L.; Graham, M.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jul 1981. Contract AC06-77RL01030. 96p. NTIS, PC A05/MF A01. Order Number DE82005827.

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Environmental surveillance was conducted in the 200 Areas, the B-C cribs controlled area, and the 600 Area retired dry-waste-disposal sites to determine: (1) compliance with DOE requirements; (2) overall impact of site operations on the environment; and (3) adequacy of radioactive waste containment systems. The report describes the 1980 environmental surveillance activities. Environmental data collected during 1980 show that the ambient radiation levels and the radionuclide concentration levels in most uncontrolled areas are in compliance with applicable DOE and Rockwell guidelines. A few sites adjacent to tank farms, burial grounds, and operating facilities were found to have surface contamination that exceeded guidelines and were posted as Radiological Controlled areas during 1980. Data included measurements of radionuclides in air, water, soil and sediments, and vegetation, and measurements of external radiation. Routine radiological surveys were performed on the roadways and on the surface of the waste disposal sites.

58120 **Collection of radon with solid oxidizing reagents.** Stein, L.; Hohorst, F.A. (Argonne National Lab., IL). *Environmental Science and Technology;* **16**: No. 7, 419-422(Jul 1982).

Although it is generally considered to be inert, radon reacts spontaneously at ambient temperature with a number of fluorine-containing compounds, including dioxygenyl salts, fluoronitrogen salts, and halogen fluoride-metal fluoride complexes. A method for the collection of radon from air, using either dioxygenyl hexafluoroantimonate ($O_2^+SbF_6^-$) or hexafluoroiodine hexafluoroantimonate ($IF_6^+SbF_6^-$) reagent, is described. The air is passed though a drying tube and then through a bed of the reagent, which captures radon as a nonvolatile product. In tests with radon-air mixtures containing 45-210000 pCi/L of radon-222, more than 99% of the radon was retained by beds of powders (2.3-3.0 g of compound/cm^3) and pellets (7.5-10.9 g of compound/cm^3). The gas mixtures were designed to simulate radon-contaminated atmospheres in underground uranium mines. No dependence of collection efficiency upon radon concentration was observed. The method can be used for the analysis of radon-222 (by measurement of the γ emissions of the short-lived daughters, lead-214 and bismuth-214) and the purification of small volumes of air.

5004 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 56720, 58020, 58060

5005 Site Resource And Use Studies

58121 **Stochastic photolyisis: A new method for measuring rates of photosensitive reactions.** Haugen, G.R.; Steinmetz, L.L.; Hieftje, G.M.; Russo, R.E. (Lawrence Livermore Laboratory, Livermore, California 04550). *Applied Spectroscopy;* **36**: No. 3, 203-209(May 1982). Contract W-7405-ENG-48.

A new method is introduced for the measurement of photochemical or photobiological reaction rates. Based on linear response theory, the method uses a randomly modulated light source rather than a pulsed one, and uses cross-correlation analysis to extract the desired kinetic information. In operation, a randomly varying light source illuminates the reaction of interest, and the resulting fluctuations in reactant (or product) concentrations are monitored. Mathematical or instrumental cross correlation of the light source variations with those in component concentration then produces the familiar kinetic decay curve. Because the new method produces only minute concentration fluctuations, it can measure reaction rates near equilibrium; moreover, equilibrium position can be shifted by superimposing on the fluctuating light intensity a dc level. Also, because cross correlation is used, the method enjoys high signal-to-noise ratios. In the present study, the utility and practicability of the new technique are demonstrated through examination of the recombination kinetics of photolytically generated iodine atoms.

5006 Regulations

REFER ALSO TO CITATION(S) 57098, 57101, 57102, 57103, 57104, 57105, 57106, 57107, 58142

58122 (CONF-791163—) **Proceedings of the action seminar on acid precipitation.** (Sierra Club, San Francisco, CA (USA)). 1979. 319p. NTIS, PC A14/MF A01. Order Number DE82003115.

From Action seminar on acid precipitation; Toronto, Canada (1 Nov 1979).

Portions of document are illegible.

This conference has been indexed separately for the database with attention focussed on the immediate problem of acid rain in hopes that the information will help legislators and other decision-making groups with political, economic and technical issues. (PSB)

58123 **Pro and con: visibility protection.** Guccione, E. *Coal Mining and Processing;* **18**: No. 9, 70-71, 73, 76-77, 80-81(Sep 1981).

The paper is based on a debate on visibility protection from the Clean Air Act Reform Symposium held in March 1981 at Washington D.C. One of the authors describes what the law is and how it works. The second describes what visibility impairment is. The flexibility of the programmes is discussed and also its purpose.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

58124 (GSF-OE—599) **Report of the colloquium 1980 of the GSF Institut fuer Oekologische Chemie.** (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Mar 1981. 199p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

From Colloquium 1980 of the GSF Institut fuer Oekologische Chemie; Neuherberg, Germany, F.R. (11 Nov 1980).

The Institute for Ecological Chemistry of the GSF organized a public colloquium for the first time in November 1980 at which a series of recent results were presented. The 19 contributions to this meeting are printed in this report. They deal with the following main topics: Environmental studies and analytics, behaviour of chemicals under simulated atmospheric conditions, behaviour of chemicals in organisms and ecosystems and in food technology, as well as test methods on decomposition, accumulation and ecotoxicity.

5101 Basic Studies

REFER ALSO TO CITATION(S) 58187, 59089

58125 (DOE/EV/02270—1) **Energy budgets of animals: behavioral and ecological implications. Progress report, December 1, 1981-July 31, 1982.** Porter, W.P. (Wisconsin Univ., Madison (USA)). Aug 1982. Contract AC02-76EV02270. 16p. NTIS, PC A02/MF A01. Order Number DE82019269.

Portions of document are illegible.

The conceptual basis of the work is the definition of specific variables and functions of coupled heat and mass balance equations for ectotherms and endotherms. A hypothesis is proposed that soil moisture and temperature sequences and duration limit reproduction in lizards via egg incubation requirements and thereby are a major factor limiting the distribution of lizards. Preliminary results in deer mice suggest that it will be possible to calculate environmental limits to growth and reproductive potential in outdoor environments. (ACR)

58126 (ORNL/TM—8115) **FORICO: gap dynamics model of the lower montane rain forest in Puerto Rico.** Doyle, T.W.; Shugart, H.H.; West, D.C. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 61p. NTIS, PC A04/MF A01. Order Number DE82020456.

Thesis. Submitted by T.W. Doyle. Portions of document are illegible.

A model, FORICO, was developed to simulate the natural gap succession of the lower montane rain forest in Puerto Rico. The FORICO model stochastically simulates a 1/30-ha stand, and determines, on a yearly basis, the establishment, growth, and death of individual trees. Hurricane frequency and stand damage probabilities are included to mimic storm effects common to forests of the West Indies. Validation of the model was achieved by correlating diameter distributions and species ranking of model results to field data. Comparison of hurricane and nonhurricane simulations indicates that disturbance plays an important role in maintaining the composition and species diversity of the Puerto Rican rain forest.

58127 (UCRL—86217) **Evaluation of soil damping techniques used in soil structure interaction analysis of a nuclear power plant.** Nelson, T.A. (Lawrence Livermore National Lab., CA (USA)). 24 Feb 1982. Contract W-7405-ENG-48. 15p. (CONF-820707—1). NTIS, PC A02/MF A01. Order Number DE82009014.

From International conference on soil dynamics and earthquake engineering; Southampton, UK (13 Jul 1982).

A prediction of dynamic soil properties at the site of a nuclear power plant plays a very important role in the seismic analysis of the facility. Conventional modal analysis procedures can accommodate virtually any range of equivalent elastic soil stiffness which is used to characterize the site. However, high radiation damping associated with energy dissipation in the soil half-space is difficult to accommodate in an elastic modal solution to the dynamic problem. Several methods are available to combine the soil damping with the structural damping in a composite modal damping coefficient. However, even with this convenient representation, the resulting large fractions of critical damping can make modal solutions to the problems suspect. This paper is based on experience gained in this area during studies performed for the Nuclear Regulatory Commission involving seismic analyses of power plants.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 58270

58128 **Acidic precipitation: considerations for an air quality standard.** Evans, L.S. (Brookhaven National Lab., Upton, NY); Hendrey, G.R.; Stensland, G.J.; Johnson, D.W.; Francis, A.J. *Water, Air, and Soil Pollution;* **16**: 469-509(1981).

Acid precipitation, wet or frozen precipitation with a H^+ concentration greater than 2.5 μeq l^{-1}, is a significant air pollution problem. The chief precursor anions are nitrate and sulfate. Agricultural soils may benefit because of the high N and S requirements of agricultural plants. Detrimental effects to forest soils may result if atmospheric H^+ inputs significantly add to or exceed H^+ production by soils. Acidification of fresh waters of southern Scandinavia, southwestern Scotland, southeastern Canada, and northeastern United States is caused by acid deposition. These regions have in common highly acid precipitation with volume weighted mean annual H^+ concentration of 25 μeq l^{-1} or higher and slow weathering of granitic or precambrian bedrock with thin soils deficient in minerals which would provide buffer capacity. Biological effects on fresh waters are detectable below pH 6.0; many species of plants, invertebrates, and vertebrates are progressively eliminated. Generally, fisheries are severely impacted below pH 5.0 and are completely destroyed below pH 4.8. Present documenting effects of acid precipitation on terrestrial vegetation are insufficient to establish an air quality standard. For aquatic ecosystems, current research indicates that establishing a maximum permissible value for the volume weighted annual H^+ concentration of precipitation at 25 μeq l^{-1} may protect the most sensitive areas from permanent lake acidification. Such a standard would probably protect other systems as well.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 56332, 56369, 56376, 56378, 56379, 56380, 56388, 56414, 56721, 58116, 58119, 58166, 58184, 58283

58129 (AD—465307/7) **Radioactivity of open-sea plankton samples.** Folsom, T.R.; Jennings, F.D.; Johnson, M.W. (Scripps Institution of Oceanography, La Jolla, CA (USA)). 18 Apr 1958. 20p. NTIS, PC A02/MF A01.

Samples of marine organisms of the deep sea were collected by Scripps Institution of Oceanography (SIO) and were later analyzed by SIO and the U. S. Naval Radiological Defense Laboratory (NRDL). The objective was to ascertain and to report on the general relationship pertinent to the uptake of fission products by the marine organisms in order to form a background for more extensive tests on Operation Wigwam. Gross beta activities, beta absorption curves and gamma spectra were analyzed, after identification of the organisms. A radiochemical analysis was also performed. It was found: (1) that marine organisms concentrate activity from fallout fission products in the water by factors of the order of 1,000, (2) that the partition of fallout fission products in the ocean is profoundly influenced by biological processes and that a purely physical model is inadequate to predict distribution, (3) that the feeding mechanism of the organism does not clearly determine the amount of activity assimilated, (4) that there is evidence of fractionation of isotopes by different organisms, and (5) that there is some evidence that finely despersed activity is retained more or less proportionally with the dry weight of the organism.

58130 (CERN—81-15) **Radiological impact of the LEP project on the environment.** Goebel, K. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 19 Nov 1981. 190p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE82701836.

Translated from the English original CERN—81-08.

The siting of the large electron-positron (LEP) accelerator, its experimental areas, and its supporting infrastructure are discussed with respect to the radiological impact on the surrounding areas and on the population in the Pays de Gex and the Canton de Geneve. The final conclusions are based on work done by the former LEP Study Group and by the LEP Radiation Working Group. The calculations and estimates show that the stray ionizing radiation, the radioactivity, and the radiation-induced noxious chemical products released by the LEP installation will have only an insignificant impact on the area, the individual members of the public, and the population as a whole. This result for LEP phase 85 can also be extrapolated under reasonable assumptions for LEP 125 - a possible future development phase of the present project.

58131 (CONF-820729—1) **Simulation of radionuclide transport in U.S. agriculture.** Sharp, R.D.; Baes, C.F. III. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE82018164.

From Summer computer simulation conference; Denver, CO, USA (19 Jul 1982).

Because of the recent concern about the impact of energy technologies on man and related health effects, there has emerged a need for models to calculate or predict the effects of radionuclides on man. A general overview is presented of a model that calculates the ingrowth of radionuclides into man's food chain. The FORTRAN IV computer program TERRA, Transport of Environmentally Released Radionuclides in Agriculture, simulates the build-up of radionuclides in soil, four plant food compartments, in meat and milk from beef, and in the livestock food compartments that cause radionuclide build-up in milk and meat from beef. A large data set of spatially oriented parameters has been developed in conjunction with TERRA. This direct-access data set is called SITE, Specific Information on the Terrestrial Environment, and contains 35 parameters for each of 3525 half-degree longitude-latitude cells which define the lower 48 states. TERRA and SITE are used together as a package for determining radionuclide concentrations in man's food anywhere within the conterminous 48 states due to atmospheric releases.

58132 (DOE/EP—0038) **Summary of annual environmental reports for CY 1980: Department of Energy nuclear sites.** (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC. Office of Operational Safety). Aug 1982. 54p. NTIS, PC A04/MF A01. Order Number DE82020467.

During CY 1980, radiation exposures to off-site populations from all Department of Energy (DOE) facilities were well within designated criteria and were similar to the 1979 levels. The maximum reported individual whole body dose to any member of the public from any DOE site was 15 mrem for the year. The total population dose within an 80 km (50 mi) radius of all sites reporting was 240 man-rem from DOE operations, compared to a total of nearly eight million man-rem to the same populations from natural sources. Nonradiological releases in site effluents were generally within prescribed regulatory limits, with several facilities having pollution abatement projects planned or under construction to correct noncompliance conditions. Inadvertent releases of radioactive and nonradioactive pollutants had no significant health or ecological impacts.

58133 (INIS-mf—7092, pp vp) **Radioactivity and ionizing radiation in Czechoslovak nuclear power plants and in their vicinity - problems of monitoring.** Melichar, Z.; Blazek, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)); Vlcek, K. (Federalni Ministerstvo Paliv a Energetiky, Prague (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

An analysis is made of problems related to the monitoring of radioactivity and ionizing radiation in nuclear power plants and their environment. It is demonstrated that in spite of radioactive effluents the radiation dose from nuclear power plants comprises less than 1% of the total dose from the environment. A survey is given of radionuclides contributing to the total dose absorbed by certain body organs of man. Methods are described of the monitoring of radionuclides and radiation in nuclear power plants and their environment during operation of the plant.

58134 (INIS-mf—7092, pp vp) **Application of mathematical models in assessing environmental impacts of nuclear facilities.** Dlouhy, Z. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

Mathematical models are divided into atmospheric models which monitor the migration of radioactive substances in the atmosphere, hydrological models which monitor the discharge of radioactive substances into the hydrosphere and their concentrations in sediments, water flora and fauna, and hydrogeological models which monitor the migration of radioactive substances in ground water. The application is described of the hydrogeological model in the evaluation of the radiation burden in the environment of the Dobronin radioactive waste disposal site. This model contains the determination of the maximal amounts of disposed radioactive substances, maximal design-basis accident, the amounts of leached radioactive substances, the calculation of the time of migration of substances in the soil, the determination of the dispersion in the aquifer and the determination of the radiation burden of the population.

58135 (INIS-mf—7092, pp vp) **Radiation monitoring systems of nuclear power plants and experience with their operation.** Moravek, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)); Feik, K. (Atomova Elektraren Bohunice, Jaslovske Bohunice (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

Radiation monitoring is divided into the monitoring of the movement of radioactive substances in the nuclear power plant, the monitoring of the radiation situation inside the operating areas and the monitoring of the radiation situation in the environment of the nuclear power plant. Technical means for securing radiation monitoring are divided into the centralized system of radiation monitoring, sampling and portable monitoring instruments. The current state and experience gained with the operation of the A-1 and V-1 nuclear power plants in Czechoslovakia where dosimetric units have been set up for securing radiation safety are described.

58136 **(NUREG—0837-Vol.2-No.1) NRC TLD direct radiation-monitoring network. Progress report, January-March 1982.** Costello, F.; Thompson, T.; Cohen, L. (Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). Jul 1982. 186p. NTIS - GPO.

The Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network is operated by the NRC in cooperation with participating states. This report presents the radiation exposure levels measured in the vicinities of fifty-six NRC-licensed facilities throughout the country and includes facilities under construction as well as those which are in operation. A complete listing of the sites monitored is included. Each site is monitored by approximately 40 TLD stations located in concentric rings. Three sets of data are presented for each site. The first set includes the TLD station number, its direction and distance from the site, the integrated exposure for the period, and the exposure normalized to a ninety day quarter (standard quarter). The second set of data summarizes in tabular form the average exposure measured in each of the sixteen standard windrose sectors around the facility and normalized to a standard quarter. The third set of data summarizes the average exposure measured at three ranges of distances from the facility and normalized to a standard quarter. A change has been made this quarter in the number of elements being used to determine exposure on a routine basis. Previously, all four elements of the dosimeter (two lithium borate elements, two calcium sulfate elements) were used in calculating exposure. Based on studies of the reproducibility and other response factors of the dosimeter, it was determined that for routine measurements the precision of the results can be improved by using only the two calcium sulfate elements. In the event of an unusual situation involving possible exposures due to low energy photons or beta radiation, the data from the lithium borate elements will also be used.

58137 **(ORNL—5768) Agricultural production in the United States by county: a compilation of information from the 1974 census of agriculture for use in terrestrial food-chain transport and assessment models.** Shor, R.W.; Baes, C.F. III; Sharp, R.D. (Oak Ridge National Lab., TN (USA)). Jan 1982. Contract W-7405-ENG-26. 347p. NTIS, PC A15/MF A01. Order Number DE82006143.

Portions of document are illegible.

Terrestrial food-chain models that simulate the transport of environmentally released radionuclides incorporate parameters describing agricultural production and practice. Often a single set of default parameters, such as that listed in USNRC Regulatory Guide 1.109, is used in lieu of site-specific information. However, the geographical diversity of agricultural practice in the United States suggests the limitations of a single set of default parameters for assessment models. This report documents default parameters with a county-wide resolution based on analysis of the 1974 US Census of Agriculture for use in terrestrial food chain models. Data reported by county, together with state-based information from the US Department of Agriculture, Economic and Statistics Service, provided the basis for estimates of model input parameters. This report also describes these data bases, their limitations, and lists default parameters by county. Vegetable production is described for four categories: leafy vegetables; vegetables and fruits exposed to airborne material; vegetables, fruits, and nuts protected from airborne materials; and grains. Livestock feeds were analyzed in categories of hay, silage, pasture, and grains. Pasture consumption was estimated from cattle and sheep inventories, their feed requirements, and reported quantities of harvested forage. The results were compared with assumed yields of the pasture areas reported. In addition, non-vegetable food production estimates including milk, beef, pork, lamb, poultry, eggs, goat milk, and honey are described. The agricultural parameters and land use information - in all 47 items - are tabulated in four appendices for each of the 3067 counties of the US reported to the Census of Agriculture, excluding those in Hawaii and Alaska.

58138 **Field survey of the shallow land low-level radioactive waste burial site near Beatty, Nevada.** Nielson, H.L.; Wogman, N.A.; Kirby, L.J. (Battelle, Pac Northwest Lab, Richland, WA). *Proceedings of the Symposium on Waste Management;* **2**: 707-719(1981). (CONF-810217—).

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

High resolution gamma-ray spectrometry was used to determine radioactivity levels in surface soil at the site as part of an effort to confirm the boundaries of existing waste burial trenches, locate any additional radioactive wastes beyond the established burial area, characterize the distribution of radionuclides around the waste burial site, and determine whether movement of radioactivity from unearthed waste drums had occurred. Cesium-137, /sup 60/ Co, and some other radionuclides were measured around the perimeter fence and in the area where waste drums were excavated along the northern fence. The data are compared with information generated by subsurface pulsed radar techniques. In addition, the in-situ counting measurements were compared with analyses of soil samples taken below ground surface at each counting location.

58139 **Chemical species of migrating radionuclides at Maxey Flats and other shallow land burial sites.** Kirby, L.J. (Battelle, Pac Northwest Lab, Richland, WA). *Proceedings of the Symposium on Waste Management;* **2**: 721-733(1981). (CONF-810217—).

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

A research program is described for the determination of chemical species of migrating radionuclides at shallow land burial sites. An experimental trench and inert atmosphere sampling wells were installed at Maxey Flats to establish the means for study of saturated and unsaturated flow in and near a simulated waste burial trench and a waste burial trench. Preliminary results establish that plutonium exists in the subsurface water entering the experimental trench mostly in the reduced forms. Related measurements of surface distributions of radionuclides at Maxey Flats confirm that surface contamination has been retained largely within the fenced area.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 56043, 56045, 56212, 56213, 56214, 56215, 56216, 56217, 56307, 56390, 58216, 58225

58140 **(PB—82-157785) Final environmental impact statement and report: North Monterey County facilities plan. Volume I.** (Monterey Peninsula Water Pollution Control Agency, CA (USA)). Aug 1977. 611p. NTIS, PC A99/MF A01.

The North Monterey County Wastewater Facilities Plan will provide additional waste treatment capacity at a consolidated regional facility to handle the reasonable growth in the North Monterey County area. The project will be constructed in three elements. This document contains the revisions and additions to the Draft EIS/EIR. These are based on the comments received and further information developed on the project. Major issues raised by Comments are: Water quality issues centered on stream flow augmentation to the Salinas River, the public health agencies' comments firmly cautioned against reusing effluent for irrigation until its health effects are adequately studied and air quality comments were supportive of the EIS' impact analysis and stress the mitigation of the projects secondary air quality impact.

58141 **Land application studies of industrial waste oils.** Watts, J.R. (Savannah River Lab., Aiken, SC); Corey, J.C.; McLead, K.W. *Environmental Pollution, Series A: Ecological and Biological;* **28**: No. 3, 165-175(Jul 1982). Contract AC09-76SR00819.

Investigations to determine the environmental consequences of land disposal of waste oil were begun in 1975 at the United States Department of Energy's Savannah River Plant near Aiken, South Carolina. Waste oil (21 litres m^{-2}) was applied and mixed thoroughly into the top 15 cm of soil. Four fertiliser levels were applied and the plots were tilled for aeration at 2 and 9 months after the oil was applied. Soil core samples, taken at 3-month intervals, showed negligible vertical migration of oil and a steady decline in the oil content of the soil. One year after the initial application, microbial activity, as measured by CO_2 emanation rate, was six times as great on the sites which had oil applied as on adjacent control sites without oil. Oil biodegradation was not affected by the fertiliser levels. Plant growth on the oil-treated plots was negligible in 1975 and was restricted in 1976. In 1977, on the non-oil plots, Digitaria was the most common species, but Richardia scabra and Diodia teres were also present in significant quantities. These species were largely excluded on the oil plots so that almost all of the vegetation was Digitaria. There was no significant difference in productivity in 1977 between oil and non-oil plots.

5106 Regulations

REFER ALSO TO CITATION(S) 56414, 57098, 57101, 57102, 57103, 57104, 57105, 57106, 57107, 58182

58142 **(DOE/ER—0058-Vol.3A) Environmental compliance guide: guidance manual for Department of Energy compliance with the Endangered Species Act.** (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC. Office of the Deputy Assistant Secretary for Environment, Safety and Health). Jun 1982. 66p. NTIS, PC A04/MF A01. Order Number DE82019221.

This document provides guidance for Department of Energy (DOE) officials responsible for complying with Section 7 of the Endangered Species Act of 1973, as amended. The Endangered Species Act requires federal agencies such as DOE to ensure that none of their actions jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat for such species. The Department is required to consult with the US Fish and Wildlife Service and/or the National Marine Fisheries Service, and if advised by these agencies that an endangered or threatened species or critical habitat may be affected, prepare a biological assessment of the effects of the proposed action. The content of a biological assessment is based on existing information on the federally protected species and habitats, data and observations from limited site surveys or visits, and consultations with local experts on the species. Information in the biological assessment is used by the responsible agencies as a basis for evaluating the effects of the proposed DOE action on species federally protected.

58143 **(PB—82-154410) Requirements and alternatives for a management information system to support hazardous waste enforcement. Final report.** Hussain, E.C. (American Univ., Washington, DC. Inst. for Applied Public Financial Management). Dec 1981. 99p. NTIS, PC A05/MF A01.

The Environmental Protection Agency administers a hazardous waste management program based on the authorities contained in the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act. Within the agency, the Office of Waste Programs Enforcement is responsible for administering the enforcement provisions of the hazardous waste program. The office does not have an information system that can handle the enforcement program. This report spells out the requirements for such an information system and possible alternatives for different systems to handle the enforcement job. Various constraints on the systems are also discussed.

52 ENVIRONMENTAL SCIENCES, AQUATIC

REFER ALSO TO CITATION(S) 58124

5201 Basic Studies

REFER ALSO TO CITATION(S) 56162, 58187

58144 **(AD-A—102047) Ecology and distribution of the benthic community on the monterey breakwater, monterey, california.** Busch, S.J. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1981. 130p. NTIS, PC A07/MF A01.

The Monterey breakwater was studied to determine an ecological baseline. The plants and animals occupying meter square quadrats along a cross sectional transect covering the breakwater and the adjacent mud bottom out to depths of 13 meters was surveyed qualitatively and quantitatively. It is found that the differences between the populations of the inner and outer parts of the breakwater are minor and those differences are in the relative abundance of only a few species.

58145 **(CEA-CONF—5875) Global isotopic model to interpret deuterium and oxygen 18 variations in rain and snow.** Jouzel, J.; Merlivat, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). Aug 1981. 1p. (CONF-8108129—1-Summ.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702350.

From Symposium on variations in the global water budget; Oxford, UK (10 Aug 1981).

58146 **(CEA-CONF—5877) 30000 yr climatic record. Main results deduced from oxygen 18 and deuterium profiles from the Dome C ice core (Antarctica).** Jouzel, J.; Merlivat, L.; Lorius, C.; Pourchet, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). Aug 1981. 1p. (CONF-8108129—2-Summ.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702351.

From Symposium on variations in the global water budget; Oxford, UK (10 Aug 1981).

58147 **(DEMO—82/1) Phytoplankton ecology of the Saronicos Gulf, Aegean Sea. Data report - Year 1981, Part 1: hydrography.** Ignatiades, L.; Karydis, M.; Vassiliou, A.; Moschopoulou, N. (Democritus Nuclear Research Center, Athens (Greece)). Feb 1982. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82906299.

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Thirty-four surveys were made in the area of Saronicos Gulf, Aegean Sea, during 1981. The stations consisted of three transects of three stations each from inshore to offshore waters. Determinations of temperature and salinity were made at 10 meter intervals. Secchi disc-light extinction, insident solar radiation, oxygen, phosphate, nitrate, nitrite, ammonia, and silicate measurements were performed at 1, 10, and 40 m depth. The results are presented in tables.

58148 **(DOE/EV/10019—2-Vol.2) Effect of increasing CO_2 on ocean biota. Volume II, Part 5. Environmental and societal consequences of a possible CO_2-induced climate change.** Holm-Hansen, O. (American Association for the Advancement of Science, Washington, DC; California Univ., San Diego, La Jolla (USA)). Jul 1982. Contract AS01-79EV10019. 26p. NTIS, PC A03/MF A01. Order Number DE82020250.

Attempts to predict the most important biological effects on the marine biota caused by increased atmospheric CO_2 concentrations and concomitant climactic changes are discussed. Particular attention is placed on phytoplankton, benthic plants, microbial cells, zooplankton, and fish stocks, and how changes in one or more of these trophic levels can result in significant changes in the nature and dynamics of the overall food web. Surface waters of the entire marine environment are considered, including the intertidal zone and estuaries; deeper waters are not considered. The major environmental factors considered are: (1) an increase in atmospheric CO_2 concentrations; (2) an increase in atmospheric temperature; (3) a decrease in pH of ocean water; and (4) an increase in atmospheric ozone concentration. The magnitude and temporal aspects of these atmospheric changes are based on previously developed models. (ERB)

58149 **(NUREG/CR—2860) Storm-surge measurements and computations for Hurricane David.** Howell, G.; Lee, D.Y.; Wang, H. (Florida Univ., Gainesville (USA). Dept. of Coastal and Oceanographic Engineering). Aug 1982. 76p. (UFL/COEL—82/005). GPO $5.00.

Portions of document are illegible.

One of the objectives of the Coastal Data Network System established and maintained by the Coastal and Oceanographic Engineering Laboratory at the University of Florida is to acquire and document storm surge data along the Florida Coast. Since the establishment of the system only one major hurricane resulted in storm surge of significance. This was Hurricane David which swept through the lower part of Florida's east coast in September 1979. Storm surge data were obtained at Miami Beach, Palm Beach, and Vero Beach. These data were analyzed and documented. In addition, the numerical storm surge model developed by Dean and Chiu was used to compute the storm surges at Palm Beach and Vero Beach to facilitate comparisons.

58150 **(PB—82-160094) South Atlantic OCS area living marine resources study: executive summary. Final report.** (South Carolina Wildlife and Marine Resources Dept., Charleston (USA). Marine Resources Research Inst.). Oct 1981. 16p. NTIS, PC A02/MF A01.

The continental shelf of the South Atlantic Bight has numerous areas of live bottom which are defined as areas containing biological assemblages consisting of such sessile invertebrates. Although live bottom areas are known to be important to commercial and recreational fisheries of the South Atlantic region, the ecology of bottom dwelling invertebrates and valuable finfish species utilizing live bottom reefs is not well understood. The primary study objectives were to characterize the invertebrate and nektonic communities associated with each live bottom area and evaluate factors which might influence community structure such as depth, latitude, bottom relief, season, and petroleum related activities.

58151 **(PB—82-171760) Environmental assessment of the Alaskan continental shelf. Volume 4. Biological studies: distribution and abundance of some epibenthic invertebrates of the northeastern Gulf of Alaska with notes on the feeding biology of selected species. Final report.** Feder, H.M.; Jewett, S.C. (Alaska Univ., College (USA). Inst. of Marine Science). Mar 1979. 811p. NTIS, PC A99/MF A01.

The operations connected with oil exploration, production, and transportation in the northeast Gulf of Alaska will present a wide spectrum of potential dangers to the marine environment. The report is an inventory of dominant invertebrates, their abundance and distribution patterns in the area of the Gulf of Alaska.

58152 **(RLO—2225-T24-49) Chemical and geochemical studies off the coast of Washington. Progress report, September 1981-July 1982.** Carpenter, R. (comp.). (Washington Univ., Seattle (USA). School of Oceanography). Jul 1982. Contract AT06-76EV70024. 20p. NTIS, PC A02/MF A01. Order Number DE82020043.

Portions of document are illegible.

Progress is reported on a series of marine chemical and geochemical investigations involving both laboratory studies and field studies off the coast of Washington. Most of the field work the past few years has been on the Washington continental shelf, slope, and the submarine canyons indenting the shelf north of the Columbia River. The aim is to provide basic data required to characterize underlying chemical and physical processes and their rates which control the distributions, concentrations, and ultimate fate of some of the potentially hazardous agents associated with fossil fuel and/or nuclear power production or transportation. Several processes of special importance in the sea, and methodologies and expertise to study them are being emphasized. Laboratory and field experiments and theories derived from them are being used iteratively to investigate: vertical transfer of trace chemicals from surface seawaters to underlying waters and sediments; processes which may transfer certain chemicals from sediments back into the overlying water column; redox processes which besides changing valence states of certain chemicals may alter their precipitation/dissolution tendencies, their biological availability and/or toxicity; and accumulation histories of potentially hazardous chemicals in sediments during the past 100 years.

58153 **Comparison of sensitivity analysis and error analysis based on a stream ecosystem model.** Gardner, R.H.; O'Neill, R.V.; Mankin, J.B.; Carney, J.H. (Oak Ridge National Lab., TN). *Ecological Modelling;* **12**: 173-190(1981).

When individual model parameters must be measured in field or laboratory experiments, the provision of feedback information for allocation of research efforts is an important function of modeling. Both sensitivity analysis and Monte Carlo error analysis can be used to determine which parameters require intensified measurement effort. When both methods are applied to a stream ecosystem model, the assumptions of sensitivity analysis are violated if reasonable estimates of measurement errors on parameters are used. Sensitivity analysis estimates a linear relationship between a state variable and a parameter and largely ignores higher order effects. In the model investigated in this study, higher-order effects dominate prediction error, and the results of sensitivity analysis are misleading. It is suggested that the simple correlation coefficient derived from analysis of Monte Carlo simulations is a more reasonable way to rank model parameters according to their contribution to prediction uncertainty. For the stream model used in this study, having variance on the four parameters, indicated as most important by sensitivity analysis, reduces prediction errors by only 2 to 6%. Halving variance on the four, completely different, parameters with the largest simple correlation coefficients reduce prediction errors by 17 to 31%.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 56054, 56059, 56060, 56163, 56165, 56166, 56167, 56168, 56201, 56220, 56222, 56223, 56386, 58128, 58152, 58267, 58270

58154 **(AD-A—110376/1) Hazard Assessment Computer System HACS/UOM users' operation manual. Volume II. Final report.** Potts, R. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Sep 1981. 126p. NTIS, PC A07/MF A01.

This volume consists of appendices which include: Chemical Recognition Code List; HACS (Hazard Assessment Computer System) Systems and Error Messages; HACS Default File; Indexes to HACS Data Fields by Field Number and by Field Name; Sample Problem and Output; Lists of Chemical Recognition Codes by Hazard Assessment Model; and by Hazard Assessment Path Codes; and Descriptions of HACS Data Fields.

58155 **(ANL/EES-TM—169) Sampling and detection of tagged dredged material.** Van Loon, L.S.; McCown, D.L.; Ditmars, J.D. (Argonne National Lab., IL (USA)). Jan 1982. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01. Order Number DE82016056.

Systems for sampling and detecting tagged dredged sand in the Upper Mississippi River were developed by Argonne National Laboratory for the U.S. Army Corps of Engineers, Rock Island District. The Corps plans to demonstrate main-channel disposal of dredged material, and it requires systems to detect the movement of the dredged material after the material has been placed in a deep reach of river. The dredged material in the demonstration will be tagged with sand particles coated with fluorescent dye. Argonne designed systems for: sampling of the bottom surficial sediments at discrete points along transects from a boat that employs a precision navigation system; on-board visual inspection of the samples for dyed sand in an ultraviolet light box; and photography of ultraviolet-illuminated samples. This report describes the systems and their use as well as the results of tests to determine proper settings for photographic equipment.

58156 **(CM—51) Inadequacy of one dimensional ocean models for the global carbon cycle.** Bjoerkstroem, A. (Stockholm Univ. (Sweden)). Feb 1981. 29p. NTIS, PC A03/MF A01.

An attempt is made to estimate the free parameters in a model of the oceanic carbon cycle, using GEOSECS data. It turns out to be impossible to set the parameters in a way that is compatible with the observed distributions of carbon and oxygen simultaneously. The result indicates that it may not be possible for any horizontally homogeneous ocean model to depict the carbon cycle in a satisfactory way. A model where Antarctic water is treated separately is required.

58157 (CONF-810488—4) **Simulated transport of polycyclic aromatic hydrocarbons in artificial streams.** Bartell, S.M.; Landrum, P.F.; Giesy, J.P.; Leversee, G.J. (Oak Ridge National Lab., TN (USA); National Oceanic and Atmospheric Administration, Ann Arbor, MI (USA); Michigan State Univ., East Lansing (USA); Savannah River Ecology Lab., Aiken, SC (USA)). 1981. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE82013446.

From International symposium on energy and ecological modelling; Louisville, KY, USA (20 Apr 1981).

Portions of document are illegible.

A model was constructed to predict the pattern of flow and accumulation of three polycyclic aromatic hydrocarbons (PAH) (anthracene, naphthalene, and benzo(a)pyrene) in artificial streams located on the Savannah River Plant near Aiken, South Carolina. Predictions were based upon the premise that the fundamental chemistry of individual PAH contains useful information for predictive purposes. Model processes included volatilization, photolysis, sorption to sediments and particulates, and net accumulation by biota. Simulations of anthracene transport were compared to results of an experiment conducted in the streams. The model realistically predicted the concentration of dissolved anthracene through time and space. Photolytic degradation appeared to be a major pathway of anthracene flux from the streams.

58158 (EDF-R—81E117738) **Maintaining of the demineralized water quality in storage tanks.** Hochmueller, K.; Wandelt, E. (Electricite de France, 92 - Courbevoie. Service Etudes et Projets Thermiques et Nucleaires). Mar 1981. 12p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702337.

Two processes for maintaining the quality of the mineralized water in storage tanks are considered. A slight overpressure of nitrogen can be created above the water, or the air flowing in the tank can be cleaned by passing it through a soda-containing lime filter.

58159 (EPRI-CS—2469) **Biofouling control assessment: a preliminary data base analysis. Final report.** Graham, J. (Lockheed Ocean Science Labs., Carlsbad, CA (USA)). Jul 1982. 215p. NTIS, PC A10/MF A01. Order Number DE82905810.

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Tightening regulations on the use of chlorine to control biofouling within electric utility cooling water systems have focused intense interest on biofouling growth and its control. This report documents an assessment of past and existing R & D and research needs relating to biofouling growth, control methods, and their impact on generating stations. The Atomic Industrial Forum's Power Database and a biofouling survey conducted by the NUS Corporation were analyzed. Chlorine use rates, injection times, and daily injection quantities were related to various plant and cooling water source characteristics. Chlorine remained the preferred biocide; mechanical cleaning methods ranked second. Wide variations in chlorine use were found, linked mainly to cooling water source characteristics. A brief literature review resulted in an annotated bibliography on biofouling and its control technologies, indexed by author, organization, and topic to enable rapid identification of individuals and organizations engaged in relevant research. Areas of research not adequately covered by existing data were identified as: a lack of an effective mechanism or process for rapidly determining condenser performance such that effective and timely biocide or cleaning operations could be implemented; a lack of information about the action of biocides on the biofilm layer and its breakdown; and a lack of comprehensive studies on alternate biocides.

58160 (NUREG/CR—1598) **Evaluation of catch-per-unit-effort indices used in aquatic monitoring programs at nuclear-power-plant sites.** McKenzie, D.H.; Skalski, J.R.; Simmons, M.A.; Metzger, R.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 114p. (PNL—3369). NTIS, PC A06/MF A01 - GPO $5.50.

Catch-per-unit-effort (CPUE) indices, or the catch of fish (in numbers or weight) per defined unit of fishing effort, have been used as a fisheries management tool and in monitoring programs at nuclear power plants. An examination of CPUE techniques was conducted with the purpose of developing guidelines for evaluating monitoring programs and interpreting the resulting information. Data bases were selected for analysis from power plant monitoring programs which: (1) had an extensive data base of at least three years; (2) made use of several fish sampling methods; and (3) had monitoring designs which incorporated replicate samples from the fish communities. Two approaches to analyzing and evaluating data bases were taken. At riverine sites, the emphasis centered on applied biological and field sampling; quantitative aspects were evaluated with graphical presentations and coefficients of variation. At the remaining sites, emphasis was placed on statistical aspects and a posteriori sampling designs and hypotheses. Data analyzed from selected programs do not provide evidence to support basic assumptions of CPUE such as proportionality of CPUE to population abundance, sufficiency of CPUE to detect changes of reasonable magnitude, and capability to assess power plant-induced change through CPUE measurement. The findings indicate that CPUE indices cannot be relied on as the sole bases for assessing population changes. Future approaches should be based on a realistic framework that integrates qualitative and quantitative components and recognizes the shortcomings of CPUE as a monitoring tool.

58161 (PB—82-167677) **Manual of Standards of Quality for Drink Water Supplies (second edition).** (Indian Council of Medical Research, New Delhi). 1975. 28p. NTIS, PC A03/MF A01.

The Indian Council of Medical Research had published a 'Manual of Standards of Quality for Drinking Water Supplies' in 1962. This Manual contains revised chemical and bacteriological standards of quality for drinking water, and may be used to serve the purpose of standardization of quality for safe water supply in order to maintain public health and reduce morbidity from various water-borne diseases.

58162 (UCRL—87650) **Water-quality monitoring at the Hoe Creek test site: review and preliminary conclusions.** Wang, F.T.; Mead, S.W.; Stuermer, D.H. (Lawrence Livermore National Lab., CA (USA)). 20 May 1982. Contract W-7405-ENG-48. 42p. (CONF-820610—7). NTIS, PC A03/MF A01. Order Number DE82015759.

From American Institute of Chemical Engineers' spring meeting; Anaheim, CA, USA (8 Jun 1982).

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It has been shown that underground coal gasification (UCG) may introduce a broad range of residual gasification products into the groundwater of a coal aquifer. Sorption of many contaminants by the coal itself is an important factor in restricting the migration of these contaminants in the ground water. However, field studies, conducted at Lawrence Livermore National Laboratory's Hoe Creek site, have shown that sorption of organic compounds by coal is not as effective as expected, perhaps because the coal surface area is limited. Furthermore, if severe roof collapse has taken place during gasification, non-coal aquifers located above the gasified coal seam may be interconnected with the coal aquifer, and contaminants may enter these non-coal aquifers, in which sorption is even less effective. The Hoe Creek II and III experiments have provided opportunities to study the contamination of a sand aquifer located above a gasified coal seam in a hydrological recharge area. Preliminary results indicate that the water in the overlying sand aquifer is much less contaminated with organic compounds than the water in the gasified coal aquifer. In conducting these field investigations, valuable lessons ere learned concerning groundwater monitoring. A suggested monitoring strategy is discussed.

58163 **Tracing kepone contamination in James estuary sediments.** Nichols, M.M. (Virginia Inst. of Marine Sciences, Gloucester Point); Cutshall, N.H. *Re'un. Cons. Int. Explor. Mer;* **137**: 102-110(1981).

The escape of Kepone into the James River estuary, Virginia, for more than nine years produced widespread contamination of the sediments with important ecological consequences. The pollutant extended seaward more than 100 km from its source and contaminated an estimated 31 million tonnes of sediment to depths of more than 60 cm. Kepone spread through the food chain and to every segment of the environment from marshes to the channel floor. Kepone escaped mainly during high river inflow from a point source in freshwater tributaries. Near the source Kepone is associated with organic material but in the lower estuary it is adsorbed on finegrained sediment. A bulk of the contaminated sediment is transported and trapped by the estuarne circulation. It accumulates in the turbidity maximum of the middle estuary far from the source. In this zone it is deposited in less energetic sites where sedimentation is relatively fast. Contamination extends downward > 60 cm; peak concentrations at 10 to 25 cm relate to high production in 1974. The Kepone inventory is now being buried by less contaminated sediment. Recovery is most rapid in the middle estuary where contamination was most intense.

58164 **Statistical inconsistencies in the use of no-observed-effect levels in toxicity testing.** Skalski, J.R. (Battelle, Pac Northwest Lab, Richland, WA). *American Society for Testing and Materials, Special Technical Publication;* No. 737, 377-387(1981). (CONF-7910273—).

From 4. annual symposium on aquatic toxicology; Chicago, IL, USA (16 Oct 1979).

Use of the no-observed-effect level (NOEL) as an experimental end point violates the principle of negative inference, the logical basis of statistical hypothesis testing. The NOEL is based on the nonrejection of the hypothesis of no toxic effect, whereas scientific methods stress conclusions based on the rejection of a hypothesis. Failure to reject this hypothesis may result either because the concentration is "safe" or because the experimental protocol to detect a toxic response is insensitive, but the cause is indeterminant and the error rate unknown. The lowest rejected concentration tested (LRCT) is recommended as an experimental end point. By the use of LRCT the rate of misclassification is known and is equal to /alpha/. Experimental designs that emphasize both the biological and the statistical significance of LRCT end points are recommended. 18 refs.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 56342, 56348, 56351, 56376, 56378, 56379, 56380, 56386, 56721, 57726, 57727, 57735, 58116, 58119, 58132, 58134, 58152

58165 **(IAEA-R—1757-F) Study of leakages at dam sites in fractured rocks with the aid of the borehole dilution technique. Final report for the period 15 December 1975 - 14 December 1977.** Ozbek, E. (International Atomic Energy Agency, Vienna (Austria)). Feb 1978. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702353.

The connection between springs which occurred after the impoundment of Keban Lake and the lake was proved by tritium measurements. By additional application of single borehole techniques using radioisotopes as tracers it was possible to localize solution channels in the karstic aquifer as preferential paths for the water movement.

58166 **(NUREG/CP—0025) Workshop on environmental assessment.** Watson, E.C. (comp.). (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 157p. (PNL—4235; CONF-811257—). NTIS, PC A08/MF A01 - GPO $6.50.

From Workshop on environmental assessment; Gaithersburg, MD, USA (15 Dec 1981).

Objectives of the workshop were: to review and evaluate the state-of-the-art of environmental impact assessments as applied to the regulation of applications of nuclear energy and related ancillary systems; to identify areas where existing technology allows establishing acceptable methods or standard practices that will meet the requirements of the NRC regulations, standards and guides for both normal operations and off-standard conditions including accident considerations; to illuminate topics where existing models or analytical methods are deficient because of unverified assumptions, a paucity of empirical data, conflicting results reported in the literature or a need for observation of operation systems; to compile, analyze and synthesize a prioritized set of research needs to advance the state-of-the-art to the level which will meet all of the requirements of the Commission's regulations, standards and guides; and to develop bases for maintaining the core of regulatory guidance at the optimum level balancing technical capabilities with practical considerations of cost and value to the regulatory process. The discussion held in small group sessions on aquatic, atmospheric, and terrestrial pathways are presented. The following research needs were identified as common to all three groups: validation of models; characterization of source terms; development of screening techniques; basis for de minimis levels of contamination; and updating of objectives for environmental monitoring programs.

58167 **(NUREG/CR—2502) Users guide and documentation for adsorption and decay modifications to the USGS solute transport model. Formal report.** Tracy, J.V. (Ertec Western, Inc., Long Beach, CA (USA)). Jan 1982. 148p. NTIS, PC A07/MF A01.

Development and user documentation for the incorporation of radioactive decay and equilibrium adsorption into the MOC solute transport model of Konikow and Bredehoeft (1974) is provided. The models of radioactive decay, linear isotherm, Langmuir isotherm, and the Freudlich isotherm, are developed as well as the basic flow and conservative transport equations for a ground water system. The report includes the theoretical developments, numerical implementations, data input requirements, a listing of the computer code that is written to comply with Fortran 77 standards, sample input and sample output, and a Bibliography of selected publications on various aspects of the transport problems.

58168 **Radionuclides in Mono Lake, California.** Simpson, H.J. (Columbia Univ., Palisades, NY); Trier, R.M.; Toggweiler, J.R.; Mathieu, G.; Deck, B.L.; Olsen, C.R.; Hammond, D.E.; Fuller, C.; Ku, T.L. *Science (Washington, D.C.);* **216**: 512-514(30 Apr 1982).

Several radioisotopes of the naturally occurring uranium and thorium decay series, in addition to fallout plutonium, have unusually high concentrations in the water column of Mono Lake, a natural alkaline, saline lake. Complexing by carbonate ions appears to be responsible for the enhanced solubility of actinide elements with oxidation states of IV to VI. In contrast, fallout strontium-90 has been largely removed from the water, probably as a result of coprecipitation with calcium carbonate. The daughter/parent activity ratios of thorium, radium, and uranium isotopes suggest that thorium is removed from the water column to the sediments on time scales substantially longer than a month and that the desorption of thorium from the sediments to the water column requires less than a few years.

58169 **Elevated concentrations of actinides in Mono Lake.** Anderson, R.F.; Bacon, M.P.; Brewer, P.G. (Woods Hole Oceanographic Inst., MA). *Science (Washington, D.C.);* **216**: 514(30 Apr 1982).

Tetravalent thorium, pentavalent protactinium, hexavalent uranium, and plutonium (oxidation state uncertain) are present in much higher concentrations in Mono Lake, a saline, alkaline lake in eastern central California, than in seawater. Low ratios of actinium to protactinium and of americium to plutonium indicate that the concentrations of trivalent actinides are not similarly enhanced. The elevated concentrations of the ordinarily very insoluble actinides are maintained in solution by natural ligands, which inhibit their chemical removal from the water column, rather than by an unusually large rate of supply.

58170 **Americium interaction with calcite and aragonite surfaces in seawater.** Shanbhag, P.M.; Morse, J.W. (Texas A & M Univ., College Station). *Geochimica et Cosmochimica Acta;* **46**: No. 2, 241-246(Feb 1982). Contract AS05-79EV10306.

Observations of the distribution of ^{241}Am in the marine environment indicate that Am has a high affinity for solid surfaces. The adsorption of Am onto calcite and aragonite surfaces from seawater and related solutions has been studied, in order to establish the interaction of Am with a major component of many marine sediments. Results indicate that Am is rapidly and strongly adsorbed. This occurs even when both dissolved Am concentrations and solid to solution ratios are low. The minimum value for K/sub D/ determined is 2 x 10^5. Measurements of reaction kinetics established that Am is adsorbed from seawater at 40 times the rate per unit surface area on synthetic aragonite that it is on synthetic calcite. Approximately 15% of the difference is attributable to epitaxial influences, with the remainder being due to enhanced site competition by Mg on calcite relative to aragonite.The adsorption rate is first order with respect to Am concentration, but follows approximately the square root of the solid surface area to solution volume ratio. Adsorption rate of Am on biogenic aragonite and Mg-calcites are, within a given particle size range, close to equal. It is not possible to normalize these adsorption rates to surface area due to the differing microporous structure of biogenic carbonates. The Am adsorption rates on a shallow water calcium carbonate-rich sediment gave results which were predicted from its mineralogic mixture of components.

58171 Determination of some oxidation states of plutonium in sea water and associated particulate matter. Lovett, M.B. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Fisheries Radiobiological Lab.); Nelson, D.M. (Argonne National Lab., IL (USA)). pp 27-35 of Techniques for identifying transuranic speciation in aquatic environments. Proceedings of a technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges: techniques for identifying the speciation, jointly organized by the IAEA and the CEC and held in Ispra, Italy, 24-28 March 1980. Vienna, Austria; IAEA (1981).

From Technical committee meeting on the behaviour of transuranics in the aquatic environment and sediment-water exchanges; Ispra, Italy (24 Mar 1980).

A full description is given of an analytical procedure to separate the lower oxidation states of Pu (III and IV) from the higher oxidation states (V and VI). This is possible by the simultaneous use of two isotopic tracers, ^{242}Pu(IV) and ^{236}Pu(VI), which are added as early as possible in the analytical scheme. Various aspects of the chemical processes are discussed, as are the procedures adopted for the preparation of the tracer solutions.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 58148, 58183, 58185, 58244

58172 (NUREG/CR—1939-V4) Ecological studies of wood-boring bivalves in the vicinity of the Oyster Creek Nuclear Generating Station: progress report June-August 1981. Quarterly progress report 1 Jun-31 Aug 81. Hoagland, K.E.; Crocket, L. (Lehigh Univ., Stone Harbor, NJ (USA). Wetlands Inst.). Jan 1982. 52p. NTIS, PC A04/MF A01.

The species composition, distribution, and population dynamics of wood-boring bivalves are being studied in the vicinity of the Oyster Creek Nuclear Generating Station, Barnegat Bay, New Jersey. Untreated wood test panels are used to collect organisms at 12 stations. Physiological tolerances of 3 species are also under investigation in the laboratory. Competition among the species is being analyzed. In the summer of 1981, Teredo bartschi occurred in large numbers at one station in Oyster Creek, but did not appear in significant numbers in Forked River.

58173 (PNL-SA—9978) System for remote monitoring of changes in aquatic habitat resulting from water-level fluctuations. Neitzel, D.A.; Becker, C.D.; Fickeisen, D.H. (Pacific Northwest Lab., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 4p. (CONF-820837—1). NTIS, PC A02/MF A01. Order Number DE82019213.

From American Fisheries Society symposium on aquisition and utilization of aquatic habitat inventory information; Billings, MT, USA (1 Aug 1982).

We used a remote, pressure-sensitive radiotelemetry system to monitor water-level fluctuations in sloughs along the Hanford Reach of the Columbia River below Priest Rapids Dam. The sloughs are important spawning and nursery areas for smallmouth bass and other resident fish. Water levels in these sloughs fluctuated as much as 2 m in 24 hours. The impact to aquatic communities in the sloughs varied with river discharge and with air and river water temperatures. Changes in slough water temperature, which fluctuated as much as 14°C in 24 hours, were one of the major impacts to the aquatic habitat.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 56045, 56047, 56049, 56169, 56170, 56171, 56218, 56463, 56464, 56714, 58140

58174 (DOE/NBM—2016055) OTEC environmental benchmark survey Kahe Point, Oahu, May 1980-May 1981. Final report. Noda, E.K.; Bienfang, P.K.; Kimmerer, W.J.; Walsh, T.W. (Lawrence Berkeley Lab., CA (USA); Noda (E.K.) and Associates, Honolulu, HI (USA); Oceanic Inst., Waimanalo, HI (USA); Hawaii Univ., Kaneohe (USA). Hawaii Inst. of Marine Biology). Sep 1981. Contract W-7405-ENG-48. 515p. NTIS, PC A22/MF A01. Order Number DE82016055.

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Six biological/chemical cruises at two stations off Kahe Point, Oahu, Hawaii which took place between May 1980 and May 1981 are detailed. The objective was to evaluate the variability of physical, chemical, and biological variables within a potential OTEC siting area over a yearly cycle. The minimum ΔT observed between surface waters and 700 m was about 19°C. Nutrient concentrations showed typical profiles with the largest variability occurring at depth. Strong positive correlations exist between nitrate and both phosphate and silicate. Both dissolved organic nitrogen and phosphorus are highest in the surface mixed layer, decline through the nutricline, and become relatively constant near 900 m. Nutrient concentrations also showed significant variation with time of year and between stations in both near surface and deep water. The vertical distribution of chlorophyll a showed a maximum between 55 m and 120 m. The euphotic zone extended to about 130 m. Total biomass concentrations were uniform in the upper 80 m declining with depth. Primary productivity was uniform with depth down to 90 m and then declined. Phytoplankton measurements varied mainly with depth and time of year. Zooplankton biomass and number were higher in surface waters and decreased with depth. As with nutrient and phytoplankton data, zooplankton variability was greatest with depth. However, zooplankton measurements showed significant differences between day and night. Additionally, small but significant variations due to time of year and station-to-station were observed. Zooplankton taxonomic analyses from these two sites were consistent with analyses from other tropical sites.

58175 (PB—82-159674) Water resources data for West Virginia, water year 1980. Appendix - coal areas. Water-data report 1 Oct 1970-30 Sep 1980. (Geological Survey, Charleston, WV (USA). Water Resources Div.). Oct 1981. 233p. NTIS, PC A11/MF A01.

Water resources data for the 1980 water year for coal regions of West Virginia consist of discharge and water-quality records collected during two sampling periods at 369 sites. Also included are sediment data from 26 sites. Data was collected as a part of the statewide Coal Hydrology project.

58176 (PB—82-159948) 13(a) assessment of the Rio Grande Region. Final report. (Camp Dresser and McKee, Inc., Austin, TX (USA)). Sep 1981. 87p. NTIS, PC A05/MF A01.

The report summarizes results of an assessment of water requirements, water availability and other water implications of the development of emerging, nonnuclear energy technologies in the Rio Grande Region. The technologies assessed include advanced coal combustion, geothermal energy, small-scale/low-head hydropower, and enhanced oil recovery.

58177 (PB—82-160102) South Atlantic OCS area living marine resources study. Volume I: an investigation of live bottom habitats south of Cape Fear, North Carolina. Final report. (South Carolina Wildlife and Marine Resources Dept., Charleston (USA). Marine Resources Research Inst.). Oct 1981. 329p. NTIS, PC A15/MF A01.

The major objectives of this study were to (1) characterize benthic and nektonic communities associated with representative live bottom habitats on the continental shelf of the South Atlantic Bight, and (2) evaluate factors which might influence these communities, particularly the potential for impact by offshore oil and gas activities. The study areas include nine live bottom areas located off South Carolina, Georgia and Florida.

58178 (PB—82-160110) **South Atlantic OCS area living marine resources study. Volume II: an investigation of live bottom habitats north of Cape Fear, North Carolina. Final report.** (South Carolina Wildlife and Marine Resources Dept., Charleston (USA). Marine Resources Research Inst.). Oct 1981. 146p. NTIS, PC A07/MF A01.

The major objectives of this study were to (1) characterize benthic and nektonic communities associated with representative live bottom habitats on the continental shelf of the South Atlantic Bight, and (2) evaluate factors which might influence these communities, particularly the potential for impact by offshore oil and gas activities. The report describes three study sites at the edge of the continental shelf in a 55-100m depth zone, near Cape Fear, North Carolina.

58179 (PB—82-161787) **Water resources reference base for the 13(a) assessment of the Rio Grande Region. Technical memo.** Brandes, R.J.; Kier, R.S.; Stecher, L.S. (Camp Dresser and McKee, Inc., Austin, TX (USA)). Sep 1981. 86p. NTIS, PC A05/MF A01.

The report is an assessment required by law to determine present and future water supplies for emerging energy technology. The area described is the Rio Grande region. Water quality and water law are also discussed in the report.

58180 (RHO-BWI-LD—33) **Preliminary evaluation of water-resource development and potential within the Pasco Basin.** Bell, N.M.; Leonhart, L.S. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Nov 1980. Contract AC06-77RL01030. 256p. NTIS, PC A12/MF A01. Order Number DE82007010.

Portions of document are illegible.

This report was prepared in conjunction with the Basalt Waste Isolation Project in partial fulfillment of requirements to assess the effects of a deep geologic repository for radioactive wastes upon adjacent water resources within the Pasco Basin. Because of the many unanswered questions with respect to repository siting, environmental characterization, engineering design, and other factors related to the proposed facility, it is somewhat premature to present an intensive evaluation of such effects. However, it is considered appropriate at this time to speculate, in a generic fashion, upon the nature of these effects as a basis for future scenario evaluations. Accordingly, this report provides the following: (1) general information and data on the nature of water resources present within the Pasco Basin; (2) a description of present and, to the extent possible, a prediction of future use and trends; (3) speculation with respect to possible interfaces between the repository and adjacent water resources. Background information describes the setting of the Pasco Basin with respect to the physical and socioeconomic resources present. Uses of the water resource, with particular regard to industrial, agricultural, municipal, recreational, and river barging and transportation are described, and a matrix serves to show the existing administrative structure. For the groundwater system, three scenarios were evaluated briefly: importation and application of surface water for irrigation, excessive discharge from wells, and subsidence related to dewatering. In conclusion, it was determined that intrusion into the deeper groundwater systems within the Wanapum Basalt for well development is a foremost consideration with respect to scenarios involving contaminant release to the biosphere.

5206 Regulations

REFER ALSO TO CITATION(S) 57098, 57101, 57102, 57103, 57104, 57105, 57106, 57107, 58142

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 58124

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 56110

58181 (PB—82-154261) **Economic impact of implementing volatile organic compound Group II regulations in Ohio. Final report Jun-Dec 81.** Formento, J.W.; Chaudhry, R.; Ploski, T.J.; Klickman, M. (Dames and Moore, Park Ridge, IL (USA)). Dec 1981. 263p. NTIS, PC A12/MF A01.

The major objective of the contract effort was to determine the direct economic impact of implementing Reasonably Available Control Technology (RACT) standards in Ohio. The study is to be used primarily to assist EPA and Ohio decisions on achieving the volatile organic compound (VOC) emission limitations of the RACT standards. The economic impact was assessed for the following eight RACT industrial categories: petroleum refinery fugitive emissions; surface coating of miscellaneous metal parts and products; gasoline tank trucks; synthesized pharmaceutical manufacturing; rubber tire manufacture; graphic arts; petroleum liquid storage in external floating roof tanks; and dry cleaners using perchloroethylene. The scope of this project was to determine the costs and direct impact of control to achieve RACT limitations for these eight VOC industrial categories in Ohio. Direct economic costs and benefits from the implementation of RACT limitations were identified and quantified. While secondary impacts (social, energy, employment, etc.) are addressed, they were not a major emphasis in the study.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 56056, 56643, 57129, 58117

58182 (DOE/DP/00053—T1) **Technical Manual MD-10176, Issue 1, Environmental Assessment and Planning Section: Quality Control Manual.** Hill, H.N.; Friedman, C.; Mees, W.M. (Mound Facility, Miamisburg, OH (USA)). Aug 1981. Contract AC04-76DP00053. 66p. NTIS, PC A04/MF A01. Order Number DE82015896.

This manual covers all documentation and laboratory practices at the Mound Facility. Appendices cover Organizational Chart of Environmental Assessment and Planning Section; Routine Analytical Procedures; Log Books; and Sampling and Analysis Schedule for Radioactivity. (PSB)

58183 (INIS-mf—7092, pp vp) **Nuclear power and protection of waters, forests, soil and atmosphere.** Sarnik, K. (Ministerstvo Lesneho a Vodneho Hospodarstva Slovenskej Socialistickej Republiky, Bratislava (Czechoslovakia)); Mayer, J. (Vyskumny Ustav Vodneho Hospodarstva, Bratislava (Czechoslovakia)). 1979. (In Slovak). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The common and the different characteristics of nuclear power plants and fossil-fuel power plants are described. The common characteristic is the heat pollution of the environment by warm waste water. Fine dust, sulphur dioxide and fluorine from conventional power plants seriously damage vegetation, agriculture, forestry, and the population as well. Nuclear power plants are built for maximum safety. The problem of the safety of nuclear power plants which is a very significant one is considered to have been resolved.

58184 (INIS-mf—7092, pp vp) **Radiation hygiene aspects of nuclear power development.** Sevc, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

A comparison is made of the radiation exposure of the population from nuclear power plants and other radiation sources (including medicine) with that from background radiation. The total collective dose equivalent is estimated at 8 Sv per 1000 MWe per year in connection with the whole fuel-energy cycle. Criteria, standards and the system of radiation protection implemented in Czechoslovakia are described. It is estimated that the development of nuclear energy will improve the environment in this country.

58185 (INIS-mf—7092, pp vp) **Ecological evaluation of nuclear power plants.** Brabec, E.; Mejstrik, V. (Ceskoslovenska Akademie Ved, Pruhonice. Ustav Krajinne Ekologie). 1979. (In Czech). NTIS (US Sales Only), PC A09/MF A01.

From Conference on nuclear power and the environment; Zdar nad Sazavou, Czechoslovakia (2 Apr 1979).

The environmental impact is described of a nuclear power plant from the point of contamination by radionuclides and of thermal pollution. Changes in the temperature of water are a serious interference in the water ecosystem while the contamination by radionuclides in fail-free operation of the nuclear power plant is negligible. (J.P.).

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 56211

58186 **(NUREG—0854) Final environmental statement related to the operation of Clinton Power Station, Unit No. 1. Docket No. 50-461.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). May 1982. 228p. NTIS11.

Portions of document are illegible.

This final environmental statement contains the second assessment of the environmental impact associated with operation of Clinton Power Station Unit 1 pursuant to the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51, as amended, of the NRC's regulations. This statement examines: the affected environment, environmental consequences and mitigating actions, and environmental and e conomic benefits and costs. Land-use and terrestrial- and aquatic-ecological impacts will be small. Air-quality impacts will also be small. However, steam fog from the station's cooling lake has the potential for reducing visibility over nearby roads and bridges. A fog-monitoring program for roads and ridges near the lake has been recommended. Impacts to historic and prehistoric sites will be negligible. Chemical discharges to Lake Clinton and Salt Creek are expected to have no appreciable impacts on water quality under normal conditions and will be required to meet conditions of the station's NPDES permit. The hydrothermal analyses indicate that under certain meteorological conditions (1-in-50-year drought(, the plant would have to be operated at reduced power levels in order to meet the thermal standards established by the Illinois Pollution Control Board Order PCB 81-82. The effects of routine operations, energy transmission, and periodic maintenance of rights-of-way and transmission line facilties should not jeopardize any populations of endangered or threatened species. No significant impacts are anticipated from normal operational releases of radioactivity. The risk associated with accidental radiation exosure is very low. Contentions associated with accidental radiation exposure is very low. Contentions associated with environmental issues accepted during the operating-license hearing are related to assessment of effects of low-level radiation. The net socioeconomic effects of the project will be beneficial. The action called for is the issuance of an operating license for Unit 1 of Clinton.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

58187 **On structural identification.** Travis, C.C.; Haddock, G. (Oak Ridge Natl Lab, TN). *Mathematical Biosciences;* **56**: No. 3-4, 157-173(Oct 1981).

A problem which constantly recurs when developing mathematical models of biological systems is that some model parameters are unknown. This problem takes on particular significance when the unknown parameters are analogs of biological attributes which are not directly measurable, but are nevertheless of considerable scientific interest. A natural question which arises is whether or not these unknown parameters can be estimated indirectly from observations of the response of the real biological system to certain inputs. A direct method of deciding whether or not the unknown parameters of a dynamical system can be determined uniquely from an input-output experiment is presented. The method relies on the fact that a completely controllable and completely observable system is parameter identifiable if and only if it is not algebraically equivalent to any other system.

5501 Behavioral Biology

58188 **Estimates of hybridization between two species of catostomids in the Columbia River.** Dauble, D.D.; Buschbom, R.L. (Battelle Pacific Northwest Labs., Richland, WA). *Copeia;* No. 4, 802-810(1981).

Extent of hybridization is described between two sympatric catostomids, Catostomus macrocheilus and C. columbianus, from the Hanford Reach of the Columbia River, southeastern Washington state. Estimated percentage of hybrids based on presence of intermediate meristic characters ranged from 12.4 to 14.6% of the total sucker population. Discriminant function analysis reduced subjective variability and lowered estimates of hybridization to 3.0 to 7.1%. Principal component analysis also provided evidence that the suspected hybrids were intermediate between populations of C. macrocheilus and C. columbianus. Meristic characters contributed most to all methods of treatment, with number of lateral line scales the best single criterion for species separation. Any analysis of closely related species would benefit from examination of offspring from artificial crosses and from knowledge of allopatric population characteristics. Breakdown of isolating mechanisms leading to C. macrocheilus X C. columbianus crosses may result from overlap in spawning time and incomplete habitat segregation. Morphological and coloration differences at spawning may provide a basis for species recognition, thus providing some degree of ethological isolation.

58189 **Eigenvalues of a deterministic neural net.** Gibbs, W.R. (Los Alamos National Lab., NM). *Mathematical Biosciences;* **57**: 19-34(1981).

A topological description of the logical connectivity of the deterministic limit of a neural net is related to the eigenvalues of the Markov matrix that describes its evolution in time. A specific relation is shown between these eigenvalues and memory retention. A simple concrete example illustrates how information may be stored and retrieved with this mechanism. The fundamental symmetries of the system are discussed in the context of the present limit.

5502 Biochemistry

REFER ALSO TO CITATION(S) 57722, 58209, 58218, 58220, 58222, 58223, 58245

58190 **(BNL—30619) Synthetic inactivators of kallikrein.** Shaw, E. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 6p. NTIS, PC A02/MF A01. Order Number DE82006939.

Portions of document are illegible.

Reagents were developed which bind covalently to side chains of kallikrein, thereby inactivating the enzyme. Both temporary and irreversible inhibitors have been synthesized. (ACR)

58191 **(EUR—7683-EN) Investigation of the properties of the primary electron-acceptor complex of photosystem I. Final report.** Evans, M.C.W.; Heathcote, P.; Nugent, J. (University Coll., London (UK)). 1982. 59p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

This paper describes work on the mechanism of photosystem I, in particular, with the composition of the electron acceptor system. A procedure was developed for large-scale isolation of chloroplasts from chlorophyll molecules. The purity of the particles competes with any reported preparation and stability is maintained for one week or longer. (PSB)

58192 **(SAND—82-1831C) Feasibility of imaging unstained DNA by field-ion tomography.** Panitz, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 7p. (CONF-820841—1). NTIS, PC A02/MF A01. Order Number DE82019481.

From 29. international field emission symposium; Goteborg, Sweden (9 Aug 1982).

A high field imaging technique has been described which can be used to obtain contour slice images of unstained macromolecules placed on the apex of a field-emitter tip. From a series of contour slice images, a three-dimensional reconstruction of molecule morphology can be obtained. This technique is called Field-Ion Tomography. Unlike Computer Assisted Tomography, Field-Ion Tomography can only be used to reconstruct exterior morphology. In order to apply field-ion techniques, an object must be placed on the apex of a field-emitter tip within an area close to the tip axis. Using an aqueous deposition procedure to place biomolecules within the area of the tip apex, reproducible, submonolayer coverages of ferritin were obtained. Although the procedure developed for ferritin can be used to place other biomolecules on to field-emitter tips, the procedure is difficult to apply unless there is an ample supply of the molecule of interest. In order to work with DNA, it was necessary to scale down the dosing parameters. To this end, a new dosing procedure was developed which requires only 10 λ of sample at a concentration of ≅ 5 μg/ml. (ERB)

58193 **Lymphocyte, monocyte, and granulocyte proteins compared by use of two-dimensional electrophoresis.** Gemmell, M.A.; Anderson, N.L. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 1062-1066(Apr 1982). Contract W-31-109-ENG-38.

Cellular proteins were compared from normal human blood lymphocytes, monocytes, and granulocytes, using high-resolution two-dimensional electrophoresis. The leukocytes were isolated from peripheral blood by centrifugation on density step gradients (yielding a fraction of purified granulocytes and a lymphocyte/monocyte mixture) and monocytes were subsequently separated from lymphocytes by virtue of their adherence to plastic. The cells were labeled with [^{35}S]-methionine after various intervals in culture, then solubilized and analyzed by two-dimensional electrophoresis. Although most proteins in each cell type are common to all three, there are nevertheless several specific marker proteins that distinguish one cell type from another. We also examined the appearance of these markers in three lines of cultured cells from humans (GM607, a B-lymphoblastoid line; HL-60, a promyelocytic leukemic line; and 1494, a normal skin fibroblast).

58194 **Two-dimensional electrophoretic analysis of the heat-shock-induced proteins of human cells.** Anderson, N.L.; Giometti, C.S.; Gemmell, M.A.; Nance, S.L.; Anderson, N.G. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 1084-1092(Apr 1982). Contract W-31-109-ENG-38.

Using two-dimensional electrophoresis, the responses of human cells in culture to heat shock have been investigated. These treatments result in the induction of increased synthesis of several specific proteins. One (HShock:1, SDS-molecular mass about 65 000) is increased by about 350-fold over the amount in untreated cells. Computer analysis of time-course studies indicates, however, that rates of synthesis of various proteins other than the classical heat shock proteins are affected, some of these alterations following time courses quite different from the main (HShock) inductions. The heat shock effect is thus much more complicated than previously realized. We purified the HShock:1 protein from heat-shocked human lymphoblastoid cells, and prepared a rabbit antiserum specific for HShock:1 on nitrocellulose two-dimensional gel transfers of total lymphoblastoid cell protein. A survey of mouse tissues shows high concentration of an HShock:1-like protein in the testis, and human testes also appears to contain substantial (though lower) concentrations. Using the antiHShock:1 antibody in an immunoassay, it will be possible to systematically examine HShock:1 concentrations in plasma and leukocytes, thereby opening up the possibility of a clinical test based for the first time upon an inducible aspect of cellular gene expression.

58195 **Proteins of human urine. III. Identification and two-dimensional electrophoretic map positions of some major urinary proteins.** Edwards, J.J.; Tollaksen, S.L.; Anderson, N.G. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 941-948(Apr 1982). Contract W-31-109-ENG-38.

The proteins of human urine have been mapped by high-resolution two-dimensional electrophoresis, utilizing the ISO-DALT system. Wide-range pH gradients and narrow-range acid gradients were both used in the first-dimension separations. The patterns revealed proteins ranging in relative molecular mass from 10 000 to 90 000. Proteins identified in the map included transferrin, albumin, hemopexin, α_2-HS glycoprotein, α_1-antitrypsin, Gc globulin, α_1-acid glycoprotein, Zn α_2-glycoprotein, retinol binding protein, β_2-microglobulin, the immunoglobulin light chains, and MAUP (most acid urinary protein). The use and utility of internal-charge and molecular-mass standards are described. We used electrophoretic transfer of proteins to nitrocellulose sheets and subsequent detection by immunological methods to identify some proteins.

58196 **Two-dimensional analysis of human lymphocyte proteins. III. Preliminary report on a marker for the early detection and diagnosis of infectious mononucleosis.** Willard, K.E. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 1031-1035(Apr 1982).

Two-dimensional gel electrophoretic patterns of human peripheral blood leukocytes from 12 patients with infectious mononucleosis were prepared by use of the ISO-DALT system. Before the two-dimensional separation, the leukocytes were purified by Ficoll-Paque gradient centrifugation and labeled overnight with [^{35}S] methionine. Quantitative increases in two proteins were detected in the patterns of infected leukocytes from the patients as compared with controls. Fluorescence-activated cell sorting of leukocytes from normal human peripheral blood before subsequent two-dimensional gel analysis revealed that the dramatic increase in one of these proteins (Inmono:2) could be due to shifts in the population ratios of lymphocytes, monocytes, and granulocytes. In contrast, the appearance in the infected leukocytes of a second protein, Inmono:1, could not be accounted for by cell-population shifts. Increased amounts of these two proteins have been found in every patient studied who had clinically detectable infectious mononucleosis. In addition, a patient who displayed symptoms of infectious mononucleosis but who did not have a positive result in the MONOSPOT test (Ortho) until three weeks after our analysis also demonstrated increased relative amounts of these proteins in his leukocyte pattern.

58197 **Two-dimensional analysis of human lymphocyte proteins. II. Regulation of lymphocyte proteins by a molecule present in normal human urine.** Willard, K.E. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 1074-1083(Apr 1982). Contract W-31-109-ENG-38.

Lymphocytes cultured with concentrated human urine develop many alterations. New proteins appear (Urocon proteins), while others disappear (Urocof proteins) from the two-dimensional gel pattern. This paper characterizes a human urinary leukocyte effector protein (HULEP) that is responsible for the appearance of the Urocon:11-15 proteins in human lymphocytes. The effector molecule, HULEP-1, is a protein with a relative molecular mass in the range of 29 000 to 43 000. Urocon:11-15 production, cytoskeletal changes in the lymphocyte, and the presence of added HULEP-

1 in the cultures are all directly related. This molecule appears to alter the structure of the lymphocyte by degrading actin and possibly other lymphocyte cytoskeletal proteins. Peptide maps of Urocon:11-15 and β and γ actin provide evidence that Urocon:11-15 proteins are closely related to nonmuscle actin, and may be degradation products of this major cytoskeletal protein.

58198 Two-dimensional electrophoretic analysis of human leukocyte proteins from patients with rheumatoid arthritis. Willard, K.E. (Argonne National Lab., IL); Thorsrud, A.K.; Munthe, E.; Jellum, E. *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 1067-1073(Apr 1982). Contract W-31-109-ENG-38.

Human leukocyte proteins from more than 150 patients with rheumatoid arthritis, together with age- and sex-matched controls, were analyzed by use of the ISO-DALT technique of two-dimensional polyacrylamide gel electrophoresis. Patients with ankylosing spondylitis, polymyalgia rheumatica, psoriatic arthritis, calcium tendinitis, post-infectious arthritis, and asymmetrical seronegative arthritis were also included as positive controls. Synthesis of several proteins, referred to by number as members of the Rheuma set, is shown to increase in the leukocyte preparations from patients with classical rheumatoid arthritis. Several of these proteins are specific to monocytes or granulocytes; others are of unknown cellular origin, but appear to be unique to rheumatoid arthritis. The Rheuma proteins appear to be indicators of disease activity, because their increased synthesis can be correlated with sedimentation rate and other clinical indices of rheumatoid disease activity.

58199 Cytoskeletal proteins from human skin fibroblasts, peripheral blood leukocytes, and a lymphoblastoid cell line compared by two-dimensional gel electrophoresis. Giometti, C.S.; Willard, K.E.; Anderson, N.L. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 955-961(Apr 1982). Contract W-31-109-ENG-38.

Differences in proteins between cells grown as suspension cultures and those grown as attached cultures were studied by comparing the proteins of detergent-resistant cytoskeletons prepared from peripheral blood leukocytes and a lymphoblastoid cell line (GM607) (both grown as suspension cultures) and those of human skin fibroblasts (grown as attached cultures) by two-dimensional gel electrophoresis. The major cytoskeletal proteins of the leukocytes were also present in the protein pattern of GM607 cytoskeletons. In contrast, the fibroblast cytoskeletal protein pattern contained four groups of proteins that differed from the patterns of the leukocytes and GM607. In addition, surface labeling of GM607 and human fibroblasts with ^{125}I demonstrated that substantial amounts of vimentin and actin are exposed at the surface of the attached fibroblasts, but there is little evidence of similar exposure at the surface of the suspension-grown GM607. These results demonstrate some differences in cytoskeletal protein composition between different types of cells could be related to their ability or lack of ability to grow as attached cells in tissue culture.

58200 Proteins of human milk. I. Identification of major components. Anderson, N.G.; Powers, M.T.; Tollaksen, S.L. (Argonne National Lab., IL). *Clinical Chemistry (Winston-Salem, North Carolina);* **28**: No. 4, 1045-1055(Apr 1982). Contract W-31-109-ENG-38.

Traditionally, human milk proteins are identified largely by reference to bovine milk. Hence, to identify the major proteins in human milk, we subjected human and bovine milk, in parallel, to high-resolution two-dimensional electrophoresis. Isoelectric precipitation at pH 4.6 was our criterion for distinguishing whey proteins from those of the casein complex. The α- andβ-caseins were identified on the basis of relative abundance, relative molecular mass, and relative isoelectric points. No protein disappeared from ISO-DALT patterns of human milk after rennin treatment, and no new protein comparable to bovine para K-casein appeared in the BASO-DALT patterns; this suggests that K-casein is absent from human milk. The proteins identified in human milk patterns include the α and β casein families, lactalbumin, albumin, transferrin, IgA, and lactoferrin. Numerous additional proteins seen in patterns for human milk remain to be identified.

58201 Laser-Raman spectrum of a Davydov soliton. Scott, A.C. (Los Alamos National Lab., NM). *Physics Letters [Section] A;* **86**: No. 1, 60-62(26 Oct 1981).

It is suggested that the laser-Raman spectra between 30 and 300 cm^{-1}, which have recently been observed on metabolically active cells, may reflect the internal vibrations of Davydov solitons.

58202 Ascorbate induction of collagen synthesis as a means for elucidating a mechanism for quantitative control of tissue-specific function. Swartz, R.I.; Mandell, R.B.; Bissell, M.J. (Lawrence Berkeley Lab., CA). *Molecular and Cellular Biology;* **1**: No. 9, 843-853(Sep 1981). Contract W-7405-ENG-48.

Ascorbic acid displays the characteristics of an ideal inducer of tissue-specific function in primary avian tendon cells in culture. It is a highly specific, potent stimulator of collagen synthesis, it demonstrates slow reversible kinetics, and it has no effect on growth rate of the cultured cells. Kinetic analysis of ascorbate induction of collegen synthesis was used to determine the critical steps in this complex biosynthetic pathway. Full hydroxylation of the proline residues in collagen, although probably a necessary step for collagen induction, was in itself not sufficient for achieving either increased secretion or increased synthesis. On the other hand, an increase in secretion rate, which required both the presence of ascorbate and a high cell density, did correlate with the later stimulation in procollagen production. The process of procollagen secretion, therefore, meets the minimal requirements for the rate-limiting step. The fact that the cells maintained a large pool of intracellular procollagen despite changes in the rates of translation or secretion led us to postulate a possible feedback between the level of the internal procollagen pool and the rate of procollagen synthesis.

58203 Inhibition of /beta/-glucosidase activity in Trichoderma reesei C30 cellulase by derivatives and isomers of glucose. Woodward, J.; Arnold, S.L. (Oak Ridge Natl Lab, TN). *Biotechnology and Bioengineering;* **23**: No. 7, 1553-1562(Jul 1981).

The inhibition of /beta/-glucosidase in Trichoderma reesei C30 cellulase by D-glucose, its isomers, and derivatives was studied using cellobiose and p-nitrophenyl-/beta/-glucoside as substrates for determining enzyme activity. The enzymatic hydrolysis of both substrates was inhibited competitively by glucose. This inhibition by glucose was maximal at pH 4.8 and no inhibition was observed at pH 6.5 and above. The /alpha/anomer of glucose inhibited /beta/-glucosidase to a greater extent than did the /beta/form. Compared with D-glucose, L-glucose, D-glucose-6-phosphate, and D-glucose-1-phosphate inhibited the enzyme to a much lesser extent, unlike D-glucose-L-cysteine which was almost as inhibitory as glucose itself when cellobiose was used as substrate. Fructose (2-100mM) was found to be a poor inhibitor of the enzyme. It is suggested that high rates of cellobiose hydrolysis catalyzed by /beta/-glucosidase may be prolonged by converting the reaction product glucose to fructose using a suitable preparation of glucose isomerase. 20 refs.

58204 Peptidyl chloromethyl ketones and diazomethyl ketones as protease affinity labels. Shaw, E.; Kettner, C.; Green, G.D.J. (Brookhaven National Lab., Upton, NY). pp 401-409 of PEPTIDES: synthesis - structure - function. Rich, D.H.; Gross, E. (eds.). Madison, WI; Pierce Chemical Company (1981).

From 7. annual peptide symposium; Madison, WI, USA (15 Jun 1981).

Concerns with the mechanism of action of proteases led to the development of affinity labeling reagents. The conversion of a substrate carboxyl group to a bromo- or chloromethyl ketone group led to a new class of inactivators or serine proteases, which act in part like substrates forming initially a reversible complex with the protease. Within the complex an active center histidine residue normally positioned near the carboxyl group of the substrate to take part in proton transfer steps associated with catalysis becomes alkylated instead by the chloromethyl ketone. Serine proteases are subdivided according to substrate specificity and it became evident that, although all serine proteases have an active center histidine, chloromethyl ketone derivatives of amino acids or peptides inactivate only the serine protease whose specificity is satisfied. The possibility that affinity labeling reagents might be made so selective that they could provide new classes of therapeutic reagents was appreciated early in the application of this type of chemical modification to a variety of enzymes.

5503 Cytology

REFER ALSO TO CITATION(S) 58199, 58201

58205 **Lateral diffusion in fluid systems.** MacCarthy, J.E.; Kozak, J.J. (Department of Chemistry and Radiation Laboratory University of Notre Dame, Notre Dame, Indiana 46556). *Journal of Chemical Physics;* **77**: No. 4, 2214-2216(15 Aug 1982).

It is shown that an extension of the free-volume model introduced by Cohen and Turnbull (see Refs. 6-8), can serve as a starting point in the development of a microscopic theory of lateral diffusion in membranes and monolayers. (AIP)

58206 **Towards a complete catalog of human proteins.** Anderson, N.L. (Argonne National Lab., IL). *TrAC, Trends in Analytical Chemistry (Personal Edition);* **1**: No. 6, 131-135(Feb 1982). Contract W-31-109-ENG-38.

A comprehensive protein database is essential to our understanding of cell function. Two dimensional electrophoresis is the only method at present capable of providing the information necessary for the formation of such a database.

5504 Genetics

REFER ALSO TO CITATION(S) 58188, 58217, 58220, 58240

58207 **Genetic variation for prolidase (PEP-4) in the mouse maps near the gene for glucosephosphate isomerase (GPI-1) on chromosome 7.** Skow, L.C. (Oak Ridge National Lab., TN). *Boletin del Instituto Gemologico Espanol;* **19**: No. 7/8, 695-700(1981). Contract W-7405-ENG-26.

An inherited electrophoretic variant of prolidase (EC 3.4.13.9), also called peptidase 4 (PED-4), has been discovered among inbred strains of mice. Analysis of progeny from reciprocal backcrosses established that the electrophoretic forms are expressed codominantly and that Pep-4 is located between the genes for glucosephosphate isomerase (Gpi-1) and pink-eyed dilution (p) on chromosome 7. These data define a region of conserved gene linkage between mouse chromosome 7 and human chromosome 19, as originally indicated by somatic cell hybrid studies, and imply that human prolidase (PEPD) is located in the region of human chromosome 19 pter → q13.

58208 **Nucleotide modification of tRNA in the yeast Saccharomyces cerevisiae is not affected by the psi factor which modulates suppression efficiency.** Colby, D. (Univ. of California, San Francisco); Sherman, F. *Current Genetics;* **3**: 163-165(1981).

We have examined the tRNAs of two related strains of Saccharomyces cerevisiae, Psi^+ and Psi^-, which differ with respect to an extrachromosomal genetic element that modulates the expression of genotypic and phenotypic suppression. Both the pattern of tRNAs synthesized and the level of nucleotide modificaion of several selected tRNA species were found to be the same in the Psi^+ and Psi^- strains.

5505 Metabolism

REFER ALSO TO CITATION(S) 58125, 58218

5506 Medicine

REFER ALSO TO CITATION(S) 57544, 57579, 57581, 57582, 57583, 57724, 57738, 57739, 57847, 57916, 58192, 58221, 58237

58209 (DOE/ER/10984—6, pp 185-246) **Biomedical research applications of electromagnetically separated enriched stable isotopes.** Lambrecht, R.M. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

The current and projected annual requirements through 1985 for stable isotopes enriched by electromagnetic separation methods were reviewed for applications in various types of biomedical research: (1) medical radiosotope production, labeled compounds, and potential radiopharmaceuticals; (2) nutrition, food science, and pharmacology; (3) metallobiochemistry and environmental toxicology; (4) nuclear magnetic resonance, electron paramagnetic resonance, and Moessbauer spectroscopy in biochemical, biophysical, and biomedical research; and (5) miscellaneous advances in radioactive and non-radioactive tracer technology. Radioisotopes available from commercial sources or routinely used in clinical nuclear medicine were excluded. Priorities and summaries are based on statements in the references and from answers to a survey conducted in the fall of 1981. Current requirements for enriched stable isotopes in biomedical research are not being satisfied. Severe shortages exist for ^{26}Mg, ^{43}Ca, ^{70}Zn, ^{76}Se, ^{78}Se, ^{102}Pd, ^{111}Cd, ^{113}Cd, and ^{190}Os. Many interesting and potentially important investigations in biomedical research require small quantities of specific elements at high isotopic enrichments.

58210 (DOE/ER/10984—6, pp 247-268) **Workshop on clinical applications of stable isotopes and derived radioisotopes.** Reba, R.C. 1982. NTIS, PC A13/MF A01. Contract FG01-81ER10984.

In Separated isotopes: vital tools for science and medicine.

The importance of the stable isotope program for the practice of clinical nuclear medicine is summarized. The author observes that medical insurors are becoming more adamant that innovative and noninvasive procedures benefit the patient in actuality and not just to advance nuclear medicine. (PSB)

58211 (DOE/EV/04533—1) **Efficacy of clinical diagnostic procedures utilized in nuclear medicine. Technical progress report, 1 December 1981-30 November 1982.** Saenger, E.L. (Cincinnati Univ., OH (USA)). Jul 1982. Contract AC02-77EV04533. 53p. NTIS, PC A02/MF A01. Order Number DE82019932.

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The efficacy of nuclear medicine diagnostic procedures was measured. Three levels of efficacy were defined. However, two different methods of evaluating efficacy itself were first compared. Using two methods, logistic regression and entropy-minimax pattern detection, substantial agreement was found between them in several clinical observations. (1) There are no attributes that indicate that any grouping of symptoms, signs, and laboratory findings is capable of suggesting that a patient does or does not have a pulmonary embolus. (2) The lung scan test is the only reliable method which indicates that a patient may have a pulmonary embolus or does not have a pulmonary embolus. (3) The validity of these conclusions and the ability to apply them widely to ongoing clinical practice is based on the prospective design of the Study which included an appropriate distribution of institutions by type, size, and geographic location. Also, the only judgement samples was that of the referring physician. (ERB)

58212 (HRP—0903872/0) **Task force report on computerized tomographic scanners.** (Bergen-Passaic Health Systems Agency, Hackensack, NJ (USA)). Oct 1978. 325p. NTIS, PC A14/MF A01.

Computerized axial tomography (CAT) scanning was the focus of a task force established by the Bergen-Passaic Health Systems Agency in New Jersey. The task force reviewed the literature on CAT technology and its applications, surveyed four northeastern hospitals with operating CAT scanning installations, and created three working subcommittees which produced written reports. It was agreed by task force members that certain criteria should be used when evaluating applications for CAT scanners, e.g., service area, staff resources, emergency room activity, radiotherapy, 24-hour scanner coverage, the medically indigent, and cost. Overall, it was determined that CAT is a proven diagnostic tool of significant value and that it should be available to residents of the Bergen-Passaic health service area. Since the CAT field is rapidly evolving and changing, however, it was not possible to define quantitatively the long-term need for and supply of CAT scanners in the region. Appendixes present supporting data on the task force findings.

58213 **(HRP—0903938/9) Therapeutic radiology services in central Viginia 1981: appropriateness review findings.** (Central Virginia Helath Systems Agency, Inc., Richmond (USA)). Jul 1981. 18p. NTIS, PC A02/MF A01.

The Central Virginia Health Systems Agency (CVHSA) has developed and implemented specific criteria and standards for Therapeutic Radiology Services. The criteria address the availability, accessibility, and cost of the services, and the quality, continuity, and acceptability of the care provided. The data and information utilized in this review were obtained primarily from a specific Appropriateness Review survey instrument which was utilized by all of the HSA's in Virginia. The three institutional providers of megavoltage radiation therapy in HSA IV comply with the majority of CVHSA criteria and standards pertaining to availability, accessibility, and cost of services. Despite the fact that the Cobalt 60 unit at the McGuire Clinic provided treatment to less than 300 new patients during 1980, available evidence suggests that utilization of this unit will continue to grow during the next five years. Existing megavoltage units in HSA IV should be sufficient to absorb the total demand for radiation therapy services through 1985. The institutional providers of megavoltage radiation therapy comply with the majority of CVHSA criteria and standards pertaining to quality, continuity, and acceptability of care.

58214 **(HRP—0904057/7) Task force report on computed tomography.** (Health Systems Agency of Southwestern Pennsylvania, Inc., Pittsburgh (USA)). 28 Jul 1981. 33p. NTIS, PC A03/MF A01.

The relatively new radiological device of computed tomography is explained, and attention is directed to planning efforts for this service. The report was prepared to best reflect the intent and recommendations of the Task Force of the Southwestern Pennsylvania Health Systems Agency. The qualitative guidelines for the Computerized Tomographic (CT) Scanner cover the following: general facility considerations; general equipment considerations; regionalized programs; staffing and programs; types of CT technology; coordination and communication; and general planning considerations. The reported utilization of scanners in the region were reviewed, and technical reports on the capabilities of CT scanners were evaluated. An appendix presents an international classification of diseases which might indicate a need for scanning.

58215 **(HRP—0904070/0) Computed tomography (CT) scanning in mid-Michigan, 1981.** (Central Michigan Medical Care Review, Inc., East Lansing (USA)). 1981. 278p. NTIS, PC A13/MF A01.

During February and March 1981, data on computed tomography (CT) utilization was collected from hospitals, referring physicians, and CT facilities in the Lansing, Michigan, area. Regional need was projected using both population-based and Leonard methodologies. Both projections fall within 10 percent of actual head scan utilization, but body scan utilization is only 50 percent of the lower projection. Sixty-one percent of scans were performed on outpatients, and 50 percent of the inpatients receiving scans required transportation to another facility. The financial break-even level for the two area scanners is approximately 2,000 visits annually per scanner. Both scanners were maintaining a positive net present value. Further evaluation of the medical appropriateness of CT scans and an update of the screening criteria are recommended. Reimbursement policies for CT scanning should be evaluated, education sessions on appropriate CT use should be conducted, and in-depth reviews of selected types of CT orders should be performed. Appendices include survey instruments; indications and criteria for CT head and body scanning; sample protocols; the Leonard methodology; the CT planning policies of the Michigan Department of Public Health; and comments on net present value analysis. A bibliography, glossary, tables, and figures are included.

5507 Microbiology

REFER ALSO TO CITATION(S) 56214, 56215, 56536

58216 **(PNL—4311) Microbial colonization of retorted shale in field and laboratory studies.** Rogers, J.E.; McNair, V.M.; Li, S.W.; Garland, T.R.; Wildung, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1982. Contract AC06-76RL01830. 26p. NTIS, PC A03/MF A01. Order Number DE82020363.

The microbial colonization of retorted shale was measured in field lysimeters and laboratory with retorted shale obtained from an above-ground retort operating in the direct heating mode. In field lysimeter studies, total aerobic heterotrophic bacterial colony forming units (cfu), as measured by a selective plating medium in surface horizons of retorted shale and adjacent soils, were similar (3.3×10^6 and 2.7×10^6 bacterial cfu/g dry weight) two months after disposal. However, unlike the soil that exhibited a diverse community, the retorted shale was dominated by a single Micrococcus species that composed 30% of the total bacterial community. After one and two years, the total aerobic heterotrophic bacterial cfu in the retorted shale and soil were again similar; however, no bacterium dominated either community. A core sample from the field lysimeter indicated microbial colonization to a depth of 150 cm after one year. An increased ratio of anaerobic to aerobic heterotrophic bacterial cfu in the deepest sample (120 to 150 cm) implied the development of anaerobic conditions. In the laboratory, aerobic heterotrophic bacteria were shown capable of using, as the sole source of carbon, retorted shale in liquid cultures. Of the added nutritional amendments, PO_4^{-3}, NO_3^- and SO_4^{-2}, only phosphate markedly altered the colonization of retorted shale in liquid culture; shortening the lag phase of colonization from less than three to seven weeks to less than one week and leading to a greater aerobic heterotrophic population over the incubation interval. The addition of phosphate also led to a aerobic heterotrophic bacterial community composed entirely of Micrococcus species.

58217 **Characterization of Fv-1 gene-product-mediated resistance transfer.** Rascati, R.J.; Otten, J.A.; Brown, A.; Hannan, J.E.; Yang, W.K.; Tennant, R.W. (Oak Ridge National Lab., TN). *Intervirology;* **15**: 87-96(1981). Contract W-7405-ENG-26.

Fv-1 gene-specific resistance to ecotropic murine retroviruses can be transferred to permissive cells with RNA prepared from restrictive cells. The active RNA has a sedimentation coefficient of 20-22S at low ionic strength and multiple regions of activity (5-6S, 10-12S, 24-27S) at high ionic strength. The maximum level of resistance transfer cannot be enhanced with noninhibitory carrier RNA or facilitators of RNA uptake, and the maximum inhibition (40-60%) is independent of the MOI. The low efficiency of resistance transfer is, therefore, probably the result of a fraction of cells resistant to RNA uptake.

58218 **Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms.** Ljungdahl, L.G.; Bryant, F.; Carreira, L.; Saiki, T.; Wiegel, J. (Univ. of Georgia, Athens). pp 397-419 of Trends in the biology of fermentations for fuels and chemicals. Hollaender, A.; Rabson, R. (eds.). New York, NY; Plenum Publishing Corporation (1981). Contract AS09-79ER10499.

In this presentation, researchers have discussed that the acetogenic thermophilic bacterium, Clostridium thermoaceticum, ferments glucose almost quantitatively to acetate. That part of the acetate is formed from CO_2, which functions as the electron sink. Researchers have demonstrated that enzymes in the acetate formation contain trace elements such as iron, cobalt, nickel, selenium and tungsten. Furthermore, researchers have indicated that this bacterium must have an electron transport system, which is not yet completely understood. With Clostridium thermohydrosulfuricum results have been obtained which indicate that this thermophile may selectively produce proteins dependent on the environmental temperature. Researchers have presented a new bacterium, Thermoanaerobacter ethanolicus, which ferments several sugars including starch, cellobiose, and xylose to ethanol. The existence in a thermal environment of anaerobic bacteria that grow at temperatures of around 90°C and which are capable of fermenting diverse substrates such as lactate, glucose, and cellulose, have been demonstrated.

5508 Morphology

58219 **(UCD—472-504) Nasal airway anatomy and inhalation deposition in experimental animals and people.** Schreider, J.P. (California Univ., Davis (USA). Lab. for Energy-Related Health Research). Sum 1982. Contract AC03-76SF00472. 29p. NTIS, PC A03/MF A01. Order Number DE82020262.

The anatomical characteristics of the nasal cavities of various experimental animals and man have been presented along with particle deposition considerations. There are a number of differences and similarities between the species. Perhaps one of the most obvious examples of anatomical differences is in the structure of the turbinate regions. Some of the differences could affect deposition of various sized particles in the nasal cavities. A degree of caution, therefore, has to be exercised in extrapolating the nasal deposition characteristics from one species to another. Simple scaling calculations may not be sufficient.

5509 Pathology

REFER ALSO TO CITATION(S) 58198, 58209, 58248

58220 **(DOE/EV/03264—21) Inborn anemias in mice. Comprehensive progress report, 1 August 1979-1 June 1982, to accompany twenty-seventh renewal proposal.** Bernstein, S.E.; Russell, E.S.; Barker, J.E. (Jackson Lab., Bar Harbor, ME (USA)). 1 Jul 1982. Contract AC02-76EV03264. 71p. NTIS, PC A04/MF A01. Order Number DE82019273.

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Hereditary anemias of mice have been investigated including four macrocytic anemias, three hemolytic anemias, nonhemolytic microcytic anemia, transitory siderocytic anemia, sex-linked iron-transport anemia, an α-thalassemia, and a new target-cell anemia. Each of these blood dyscrasias is caused by the action of a unique mutant gene, which determines the structure of different intracellular molecules controlling a different metabolic process. Thus the wide range of different hereditary anemias has considerable potential for uncovering many different aspects of hemopoietic homeostatic mechanisms in the mouse and by extension to man from an understanding of mammalian mechanisms utilized in the control of erythropoiesis. Each of the different anemias is studied through: (a) biochemical and biophysical characterization of peripheral blood cells; (b) determinations of cellular and organismic radiosensitivity under a variety of conditions; (c) measurements of iron metabolism and heme biosynthesis; (d) morphological and biochemical study of blood-forming tissue; (e) functional tests of the stem cell component; (f) examination of responses to erythroid stimuli and inhibitors; and (g) physiological complementation analysis via transplantation of tissue between individuals of differently affected genotypes.

58221 **(DOE/EV/10360—3) Correlation of chromosome patterns in human leukemic cells with exposure to chemicals and/or radiation. Comprehensive progress report, January 1, 1980-December 31, 1982.** Rowley, J.D. (Chicago Univ., IL (USA)). Jun 1982. Contract AC02-80EV10360. 24p. NTIS, PC A02/MF A01. Order Number DE82019266.

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The observations that two particular translocations are consistently associated with specific differentiation stages of acute nonlymphocytic leukemia were confirmed. These are the translocation between chromosomes 8 and 21 in acute myeloblastic leukemia with maturation and the translocation between chromosomes 15 and 17 in acute promyelocytic leukemia. The observation of others that structural rearrangements involving the long arm of No. 11 are frequently seen in acute monoblastic leukemia was also confirmed. The chromosome aberrations that are observed in the great majority of patients with acute leukemia secondary to cytotoxic therapy were defined. Thus of 47 patients with secondary acute nonlymphocytic leukemia, an aneuploid clone was seen in 44, and 39 of the 44 had a loss of part or all of No. 5 and/or No. 7. I have been able to localize the region of chromosome No. 7, loss of which is important for the development of leukemia was localized. Patients with ANLL de novo whose occupational histories suggest exposure to potentially mutagenic agents have a higher frequency of aberrations involving Nos. 5 and/or 7, than do patients not so exposed. Thus 50% of exposed versus 10% of nonexposed patients had aberrations of Nos. 5 or 7.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 58220

58222 **(BNL—31593) Humoral regulation of erythropoiesis.** Miller, M.E.; Garcia, J.F.; Shiue, G.G.; Okula, R.M. (Brookhaven National Lab., Upton, NY (USA); Lawrence Berkeley Lab., CA (USA)). 1982. Contract AC02-76CH00016. 18p. (CONF-8206107—2). NTIS, PC A02/MF A01. Order Number DE82020033.

From 18. Alfred Benzon symposium - haemopoietic stem cells; Copenhagen, Denmark (13 Jun 1982).

The role of erythropoietin (Ep) in the regulation of erythropoiesis has been defined previously. Other regulators of erythropoiesis termed burst promoting factors also influence erythropoiesis in vitro but their in vivo regulatory activity remains to be proven. The newly developed radioimmunoassay (RIA) for Ep has been used to measure levels of immunoreactive Ep in rats subjected to either graded amounts of blood loss or alterations in the affinity of the hemoglobin molecule for oxygen. An attempt is made to define two unresolved areas in erythropoiesis, viz., the influence of the p 50 (pO_2 at which 50% of the hemoglobin molecule is saturated with O_2) and the effect of relatively small increments in Ep on in vivo erythropoiesis.

58223 **(DOE/EV/03139—47) Embryo culture in teratological surveillance and serum proteins in development. Comprehensive fourteen year report, 1968-1982.** Klein, N.W. (Connecticut Univ., Storrs (USA). Dept. of Animal Genetics). Jul 1982. Contract AC02-76EV03139. 34p. (COO—3139-47). NTIS, PC A03/MF A01. Order Number DE82020442.

A testing procedure is being developed which may reduce the incidence of birth defects. The procedure uses in vitro cultures of whole rat embryos. Early studies on the nutrition of embryos involved attempts to culture whole chick embryos on protein-free chemically defined media. Media containing proteins from whole egg were superior. No single protein would support growth and development, at least two proteins were required. One protein was a transferrin, the second protein could be either ovalbumin or lipovitellin. To determine the path taken by nutrient proteins from medium to embryo, radioactive ovalbumin was prepared. The results showed that intact ovalbumin was taken up by the extra-embryonic yolk-sac and degraded to constituent amino acids within this structure. This observation was difficult to reconcile with the observed responses of the embryo to nutrient proteins. Consideration was given to yolk-sac function. When isolated yolk-sacs were incubated in Ringer's salt solution, they synthesized and secreted a distinct group of proteins. Yolk-sacs cultured on media containing various protein constituents synthesized serum proteins in relative amounts that were distinct for each medium. This suggested that the embryo responses to various culture media were mediated by changes in the relative synthesis of serum proteins. This hypothesis led to two lines of experimentation: what are the mechanisms regulating the relative synthesis of serum proteins by the yolk-sac; and do serum proteins actually provide signals of developmental significance. The first question led to studies with cultures of endodermal cells while the second question led to work on the development of a test for teratological surveillance. (ERB)

58224 **Corneal-shaping electrode.** Doss, J.D.; Hutson, R.L. (to Department Of Energy). US Patent 4,326,529. 27 Apr 1982. Filed date 5 Dec 1979. vp.

PAT-APPL-100664.

The disclosure relates to a circulating saline electrode for changing corneal shape in eyes. The electrode comprises a tubular nonconductive electrode housing having an annular expanded base which has a surface substantially matched to a subject corneal surface. A tubular conductive electrode connected to a radiofrequency generating source is disposed within the electrode housing and longitudinally aligned therewith. The electrode has a generally hemispherical head having at least one orifice. Saline solution is circulated through the apparatus and over the cornea to cool the corneal surface while radiofrequency electric current emitted from the electrode flows therefrom through the cornea to a second electrode, on the rear of the head. This current heats the deep corneal stroma and thereby effects corneal reshaping as a biological response to the heat.

5520 Public Health

REFER ALSO TO CITATION(S) 58264

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 56216, 56307, 56480, 56507, 56511, 58034

58225 (ORNL/TM—8335) **Whole-tree harvesting: nutrient depletion estimates and post-harvest impacts on nutrient dynamics. Third year progress report for 1981.** West, D.C.; Mann, L.K. (Oak Ridge National Lab., TN (USA)). Sep 1982. Contract W-7405-ENG-26. 127p. NTIS, PC A07/MF A01. Order Number DE82010460.

Scientists at Oak Ridge National Laboratory are coordinating investigations on the environmental effects of residue removal and whole-tree utilization for several forest types in the United States. Sites were selected to include central hardwoods, northern hardwood, northern coniferous, southern appalachian oak-hickory, northwestern coniferous, and southern pine forests. All sites have been established at locations having a long history of biomass and nutrient cycling research to provide a foundation of data to assess the effects of whole-tree harvest on erosion, nutrients, water quality, and productivity. This report (the third in a series) describes the sites and sampling procedures and reports some data regarding direct effects of intensive harvesting. Harvesting, including bole-only and residue removal, is complete at most sites, and some ecosystem nutrient budgets are presented. Aboveground biomass and soil nutrient pools (N, P, K, Ca, Mg) are also given. Preliminary post-harvest effects data are discussed.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 56307, 57064, 58117, 58129, 58588

58226 (BARC—1132) **Membrane specific drugs as radiosensitizers.** George, K.C.; Mishra, K.P.; Shenoy, M.A.; Singh, B.B.; Srinivasan, V.T.; Verma, N.C. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 23p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82903350.

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Procaine, paracetamol, and chlorpromazine showed inhibition of post irradiation repair. The chlorpromazie effect could be further augmented by treatment of cells with procaine. Chlorpromazine was also found to be preferentially toxic to hypoxid bacterial cells, and the survivors showed extreme radiosensitivity to gamma rays. Chlorpromazine was found to inhibit tumour growth in swiss mice when given intraperitoneally as well as when injected directly into the tumour. When combined with single x-ray doses, significant radiosensitization was observed in two in vivo tumours sarcoma 180A and fibrosarcoma. These results indicated that chlorpromazine may prove a good drug for combined chemo-radiotherapy of solid tumours. Investigations continued studying various aspects such as effectiveness in other tumour lines, distribution in healthy and tumour bearing animals, hyperthermia and drug combination effects, and encapsulation of the drug in artificial liposomes and blood cells. (ERB)

58227 (BNL—31581) **TRITOX: a multiple parameter evaluation of tritium toxicity.** Carsten, A.L. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 36p. (CONF-820736—1). NTIS, PC A03/MF A01. Order Number DE82018100.

From 17. annual European Society for Radiation Biology meeting on effects of prenatal irradiation; Bordeaux, France (26 Jul 1982).

The increased use of nuclear reactors for power generation will lead to the introduction of tritium into the environment. The need for assessing possible immediate and long-term effects of exposure to this tritium led to the development of a broad program directed towards evaluating the possible somatic and genetic effects of continuous exposure to tritiated water (HTO). Among the parameters measured are the genetic, cytogenetic, reproductive efficiency, growth, nonspecific lifetime shortening, bone marrow cellularity and stem cell content, relative biological effectiveness as compared to ^{137}Cesium gamma exposure, and related biochemical and microdosimetric evaluations. These parameters have been evaluated on animals maintained on HTO at 10 to 100 times the maximum permissible concentration (0.03 - 3.0 μCi/ml) for HTO. Dominant lethal mutations, chromosome aberrations in regenerating liver, increased sister chromatid exchanges in bone marrow and reduction in bone marrow stem cell content have been observed at the higher concentrations. The relative biological effectiveness for HTO ingestion as compared to external ^{137}Cesium gamma exposures has been found to be between 1 and 2.

58228 (CNEN-RT/PROT—(80)30) **Evaluation of the dose to the Italian population from nuclear explosions.** Giorcelli, F.G. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Radiazioni e Ricerche di Sicurezza e Protezione). Dec 1980. 54p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82903032.

On the basis of experimental data collected in Italy, an evaluation is made of the dose commitment to the Italian population due to all the nuclear tests in atmosphere which occurred before 1976. The values obtained are compared with the average values referring to the temperate zone of the North hemisphere, published by the UNSCEAR (1977). The agreement is very good. Subsequently, on the basis of Italian experimental data, the dose commitment to the Italian population due to the nuclear tests in atmosphere which occurred in the period 1976 to 1978 is determined. The dose commitment referring to this period, mainly due to the explosion in the atmosphere of the first Chinese thermonuclear device, is about 4 mrad for gonads, 8 mrad for bone marrow and endo-osteal cells, and 6 mrad for lungs.

58229 (CNEN-RT/PROT—(80)37) **Tritium levels in the blood and urine of the normal population and in contaminated subjects.** Belloni, P.; Clemente, G.F.; di Pietro, S.; Quaggia, S. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Radiazioni e Ricerche di Sicurezza e Protezione). Dec 1980. 29p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903100.

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The data referred to the tritium concentrations measured in blood and urine samples collected from 4 contaminated subjects and 32 individuals of both sexes members of the general population are reported in this paper together with a brief introduction on the environmental behavior of tritium, on its transfer to man and on its metabolism in man. The experimental data have indicated a large variability of the individual tritium concentrations in both urine (range: 0.5 to 4.0 pCi/ml) and blood (range: 2.7 to 13.4 pCi/ml) samples collected from nonexposed subjects. The mean concentration value of tritium in urine and blood samples in non exposed subjects has been evaluated to define the levels of tritium exposure measured in exposed subjects. The mean tritium concentration in the blood of the considered exposed subjects is 186 pCi/ml while the urine is 170 pCi/ml. The data obtained have been discussed to define the use of blood and/or urine as indicators of tritium internal contaminations of exposed subjects.

58230 (DOE/EV/10417—2) Immunochemical approach to the study of DNA repair. Proposed technical program and technical progress report. (New York Medical Coll., Valhalla (USA). Dept. of Microbiology; Columbia Univ., New York (USA). Coll. of Physicians and Surgeons). 1982. Contract AC02-80EV10417. 23p. NTIS, PC A02/MF A01. Order Number DE82019938.

A simple immunochemical assay to quantify DNA lesions is being developed in order to facilitate the study of DNA repair. Antibodies have been raised to 5,6-dihydroxy-dihydrothymine and to thymine dimers and these have been used to measure DNA damages produced by osmium tetroxide and ultraviolet light, respectively. An enzyme immunoassay has been developed and the sensitivity of this method will be compared to physical, enzymatic, and chemical methods using PM2 bacteriophage DNA. Finally DNA repair will be assayed in several model systems.

58231 (EDF-CONF—80DD01949) Contamination and cancers: low-dose risks and standards of radioprotection. Vignes, S. (Electricite de France, 75 - Paris. Comite de Radioprotection). 19 Sep 1980. 12p. (In French). (CONF-8009262—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702354.

From International symposium on life quality and geocancerology; Besancon, France (10 Sep 1980).

Irradiation of the population due to the running of nuclear power stations represents less than 1% of the natural radioactivity today, and should amount to 3% at most by the year 2000. The main effects of ionizing radiations are reviewed and their undetectability below 100 rems is underlined. Thus the evaluation of low-dose risks can only be speculative and the cautions hypothesis adopted is that of a linear relationship between dose and effect, together with the absence of threshold. According to calculations the worker, supposedly exposed to 500 mrem a year between ages 18 and 65, would run a 22.2% instead of the normal 22% risk of dying of cancer. As for the population, the risk would increase by only 1 per 10,000 in the year 2000. This means that no other mutagenic and carcinogenic agent is as well regulated as radioactive pollution and efforts directed at a better control of harmful chemicals, for instance, are only taking an example from the ruling on radioprotection.

58232 (IAE—3401/3) Method of calculating collective dose irradiation in region of radioactive source. Kovalevich, O.M.; Isaev, A.N.; Shashkov, M.G.; Konobaev, A.V.; Pavlovskij, O.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 55p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702647.

Possible modifications of collective irradiation dose due to nuclear power plant discharge into the atmosphere or another radioactive waste sources are considered. The volume of information essential for calculations is discussed. The effect of different representations of standard concentration distribution deviations on the final results is analysed. A method is suggested for collective dose calculation, based on main functional tabulation. The possibilities of simplified population collective dose calculations are considered.

58233 (INER—0388) Study of chromosome aberration yield in human lymphocytes as an indicator of radiation dose. Chang, Y.N.; Chen, M.D.; Fu, Y.K.; Tsai, C.M. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). May 1981. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82903222.

Biological dosimetry which uses human lymphocyte chromosome aberrations as an indicator of radiation dose was established. Human lymphocytes culture, slide preparation, and staining techniques are described in this report. The yields of dicentric and ring chromosomes are used as parameter of radiation damage. The results show that the lower limit of the method in this experiment for the x radiation is 48.0 rads. The dose-response curves of x rays and rays fit the following equations respectively: $Y = 1.70 \times 10^{-2} - 2.18 \times 10^{-4} D + 6.84 \times 10^{-6} D^2$; $Y = 4.45 \times 10^{-3} + 2.69 \times 10^{-5} D + 3.43 \times 10^{-6} D^2$ where Y is the yield of dicentric and ring chromosomes per cell and D is the x or γ radiation dose in rads. The chromosome aberration yield induced by γ irradiation is lower than that induced by x-ray exposure. The RBEs of γ rays are 0.60 and 0.55 with respect to x rays when doses are 200 rads and 400 rads respectively.

58234 (INIS-mf—7122) Pulse radiolysis study of the electron reaction with DNA in aqueous solution and ice. Some experimental and theoretical aspects. Verberne, J.B. (Vrije Univ., Amsterdam (Netherlands)). 18 Dec 1981. 226p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE82780641.

Thesis.

Research is described into some aspects of the interaction of ionizing radiation with DNA, the main emphasis being on the indirect effect where the radiation causes the formation of intermediates in the surrounding medium which then interact with the DNA. Experiments are described which have been carried out to examine the dependence of the reaction rate constant on ionic strength and counterion charge. They show that for double stranded DNA (dsDNA) the reaction rate constant increases with ionic strength. To see whether quantitative agreement can be obtained between the observations and a physical interpretation the author combines a model for reaction kinetics and a refined model for the electrostatic potential into one to obtain a theoretical rate constant for reaction with a cylindrical polyelectrolyte. Optical absorption spectra of the electron adducts of ss- and dsDNA are shown to exist and they differ significantly from the spectra of the H and OH adducts. The spectra of the electron adducts of the nucleotides have been measured. Experiments are also described devoted to the precursor of the hydrated electron: the thermalized, dry electron. Although from a radiation chemical point of view the experiments yielded a lot of information (a direct observation of the dry electron, the kinetics of electron localization, the role of ice defects in the solvation process, etc.), they proved also that the dry electron does not react with DNA in an ice matrix. (Auth.).

58235 (LBL—14684) Genetics of x-ray induced double strand break repair in saccharomyces cerevisiae. Budd, M.E. (Lawrence Berkeley Lab., CA (USA)). Jul 1982. Contract AC03-76SF00098. 160p. NTIS, PC A08/MF A01. Order Number DE82020071.

Thesis.

The possible fates of x-ray-induced double-strand breaks in Saccharomyces cerevisiae were examined. One possible pathway which breaks can follow, the repair pathway, was studied by assaying strains with mutations in the RAD51, RAD54, and RAD57 loci for double-strand break repair. In order of increasing radiation sensitivity one finds: rad57-1(23°)> rad51-1(30°)> rad54-3(36°). At 36°, rad54-3 cells cannot repair double-strand breaks, while 23°, they can. Strains with the rad57-1 mutation can rejoin broken chromosomes at both temperatures. However, the low survival at 36° shows that the assay is not distinguishing large DNA fragments which allow cell survival from those which cause cell death. A rad51-1 strain could also rejoin broken chromosomes, and was thus capable of incomplete repair. The data can be explained with the hypothesis that rad54-3 cells are blocked in an early step of repair, while rad51-1 and rad57-1 strains are blocked in a later step of repair. The fate of double-strand breaks when they are left unrepaired was investigated with the rad54-3 mutation. If breaks are prevented from entering the RAD54 repair pathway they become uncommitted lesions. These lesions are repaired slower than the original breaks. One possible fate for an uncommitted lesion is conversion into a fixed lesion, which is likely to be an unrepairable or misrepaired double-strand break. The presence of protein synthesis after irradiation increases the probability that a break will enter the repair pathway. Evidence shows that increased probability of repair results from enhanced synthesis of repair proteins shortly after radiation. (ERB)

58236 (NUREG/CR—2503) Measurements of ^{234}U, ^{238}U and ^{230}Th in excreta of uranium-mill crushermen. Fisher, D.R.; Jackson, P.O.; Brodacynski, G.G.; Scherpelz, R.I. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. 67p. (PNL—4027). GPO $5.00.

Uranium and thorium levels in excreta of uranium mill crushermen who are routinely exposed to airborne uranium ore dust were measured. The purpose was to determine whether ^{230}Th was preferentially retained over either ^{234}U or ^{238}U in the body. Urine and fecal samples were obtained from fourteen active crushermen with long histories of exposure to uranium ore dust, plus four retired crushermen and three control individuals for comparison. Radiochemical procedures were used to separate out the uranium and thorium fractions, which were then electroplated on stainless steel discs and assayed by alpha spectrometry. Significantly greater activity levels of ^{234}U and ^{238}U were measured in both urine and fecal samples obtained from uranium mill crushermen, indicating that uranium in the inhaled ore dust was cleared from the body with a shorter biological half-time than the daughter product ^{230}Th. The measurements also indicated that uranium and thorium separate in vivo and have distinctly different metabolic pathways and transfer rates in the body. The appropriateness of current ICRP retention and clearance parameters for ^{230}Th in ore dust is questioned.

58237 **(PB—82-159963) Radiation safety in nuclear medicine: a practical guide. Final report.** Sodd, V.J. (Bureau of Radiological Health, Rockville, MD (USA)). Nov 1981. 144p. (FDA/BRH—82/31). NTIS, PC A07/MF A01.

This publication brings together, in concise form, information regarding the many recommendations and requirements for safe operation of a nuclear medicine laboratory. The need for such a compendium was perceived by the staff of the Nuclear Medicine Laboratory. This need arises from several sources. Many individuals enter the field with little training in the handling of radioactive materials; for example, a physician trained in cardiology, oncology, or neurology. The increasing development of portable instrumentation has allowed movement of radiopharmaceuticals from the confines of the nuclear medicine lab to coronary and intensive care facilities where personnel may lack adequate knowledge of safe handling procedures. A health physicist, trained to account for all radioactive material placed under his control, may have difficulty adapting to the accepted practice of releasing a patient who has been administered millicurie quantities of radioactivity, with little or no control over subsequent disposal of excreta. Further differences exist between handling practices for radioactive materials in the scientific laboratory and in the medical facility. This guide tries where possible to clarify some of these issues.

58238 **(PB—82-165036) X-ray measurements and protection, 1913-1964: the role of the National Bureau of Standards and the national radiological organizations. Final report.** Taylor, L.S. (National Bureau of Standards, Washington, DC (USA)). Dec 1981. 390p. NTIS, PC A17/MF A01.

An account of the initial U.S. concerns with, and subsequent efforts to cope with, the safe use of ionizing radiation is given. National interest was focused in the National Bureau of Standards where radiation programs were established at the urging of, and with the close cooperation of, the radiological profession. The National Bureau of Standards' ionizing radiation research programs, the first in the U.S. Government, were dedicated to establishing a sound scientific base for x-ray measurement and protection. Along with the support and constant efforts of the national and international radiological organizations, the Bureau played a critically important role in the Nation's ability to use radiation effectively and safely. Based on widely scattered files assembled from both Government and non-government sources, this document represents a single source record of significant committee papers, correspondence, and decisions during the period 1913 to 1964, along with the author's summary of National Bureau of Standards' work, and the interrelated efforts of many others in the scientific community. A complete listing of the published output of the National Bureau of Standards' radiation staff is also included in this document. These papers contribute significantly to our understanding of ionizing radiation.

58239 **Microdosimetry of lymphocytes irradiated by alpha-particles.** Fisher, D.R.; Harty, R. (Pacific Northwest Lab., Richland, WA (USA)). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* **41**: No. 3, 315-324(Mar 1982).

Although the concept of absorbed dose is commonly used in radiation biology as a parameter for comparing the toxic effect of different levels of radiation on a system, there are situations where the absorbed dose by itself is inadequate, and additional dose distribution information is required to explain the observed biological effects. A good example is the irradiation of cells by alpha-particles. This paper reports the use of internal microdosimetry techniques to reinvestigate the dosimetry of two very similar experiments with apparently contradictory dose-response results. Yields of dicentric chromosome aberrations induced in human blood lymphocytes following in vitro exposure to dissolved americium or plutonium at two separate laboratories produced linear dose-response functions, but the slopes of the best-fit straight lines differed by a factor of 12. Our microdosimetric analysis showed the results of one experiment to be inconsistent with a uniform distribution of activity. It also showed that the difference in slope could be attributed to differences in particulate size and spatial distribution as a result of dissimilarities in procedures used for preparing the actinide solutions.

58240 **Identification of a second locus in Drosophila melanogaster required for excision repair.** Boyd, J.B. (Univ. of California, Davis); Snyder, R.D.; Harris, P.V.; Presley, J.M.; Boyd, S.F.; Smith, P.D. *Genetics;* **100**: No. 2, 239-257(Feb 1982).

The mur(2)201 locus in Drosophila is defined by two mutant alleles that render homozygous larvae hypersensitive to mutagens. Both alleles confer strong in vivo somatic sensitivity to treatment by methyl methanesulfonate, nitrogen mustard and ultraviolet radiation but only weak hypersensitivity to X-radiation. Unlike the excision-defective mei-9 mutants identified in previous studies, the mus(2)102 mutants do not affect female fertility and do not appear to influence recombination proficiency or chromosome segregation in female meiocytes. Three independent biochemical assays reveal that cell cultures derived from embryos homozygous for the mus(2)/sup D/^{1} allele are devoid of detectable excision repair. 1. Such cells quantitatively retain pyrimidine dimers in their DNA for 24 hr following UV exposure. 2. No measurable unscheduled DNA synthesis is induced in mutant cultures by UV treatment. 3. Single-strand DNA breaks, which are associated with normal excision repair after treatment with either UV or N-acetoxy-N-acetyl-2-aminofluorene, are much reduced in these cultures. Mutant cells possess a normal capacity for postreplication repair and the repair of single-strand breaks induced by X-rays.

58241 **Permeabilization of ultraviolet-irradiated chinese hamster cells with polyethylene glycol and introduction of ultraviolet endonuclease from Micrococcus luteus.** Yarosh, D.B.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Molecular and Cellular Biology;* **1**: No. 3, 237-244(Mar 1981).

Chinese hamster V-79 cells were made permeable by treatment with polyethylene glycol and then incubated with a Micrococcus luteus extract containing ultraviolet-specific endonuclease activity. This treatment introduced nicks in irradiated, but not in unirradiated, deoxyribonucleic acid. The nicks remained open for at least 3 h; there was no loss of endonuclease-sensitive sites, and no excision of dimers as measured by chromatography was detected. In addition, there was no increase in ultraviolet resistance in treated cells. This suggests that the absence of a significant amount of excision repair in rodent cells is due to the lack of both incision and excision capacity.

58242 **Effects of the rad 52 gene on sister chromatid recombination in Saccharomyces cerevisiae.** Prakash, L.; Taillon-Miller, P. (Univ. of Rochester, NY). *Current Genetics;* **3**: 247-250(1981). Contract AC02-76EV03490.

Spontaneous and uv induced unequal mitotic sister chromatid recombination was examined in RAD+ and rad 52-1 strains carrying the LEU2 gene inserted in the rDNA locus. The rad 52-1 mutation does not affect spontaneous sister chromatid recombination but greatly reduces the frequency of uv induced sister chromatid recombination.

58243 **Mortality of the harvester ant (Pogonomyrmex owyheei) after exposure to ^{137}Cs gamma radiation.** Gano, K.A. (Pacific Northwest Lab., Richland, WA). *Environmental Entomology;* **10**: No. 1, 39-44(1981). Contract AC06-76RL01830.

Harvester ants, Pogonomyrmex owyheei Cole, irradiated with 3.5 kR to 268 kR of ^{137}Cs gamma radiation, were maintained at simulated summer (27°C) and winter (7°C) temperature regimes. After thirty days, the cool series was warmed to 27°C and observed for mortality along with the warm series. Though mortality was delayed in the cool series, each series reached 50% mortality at similar rates. Because the harvester ant is extremely tolerant to radiation and experimental rates used far exceed possible environmental exposure, it is unlikely that ant colonies dwelling among low-level nuclear waste storage sites will be deleteriously affected by radiation. This species has the capability of tunneling to a depth well within the range of some buried waste. Since these harvester ants are potential transporters of buried waste, they should be considered as a biotic factor in radioactive waste management operations in semi-arid regions.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 56114, 58148, 58173

58244 Fish abundance and distribution near three heated effluents to Lake Michigan. Spigarelli, S.A.; Goldstein, R.M.; Prepejchal, W.; Thommes, M.M. (Argonne National Lab., IL). *Canadian Journal of Fisheries and Aquatic Science;* **39**: No. 2, 305-315(1982).

A combined echo location-temperature mapping technique was used to determine the abundance and distribution of fish with depth and temperature in locally heated and unheated areas of Lake Michigan. Surveys were conducted between April and October at two adjacent power plants in the southern basin and at one plant in the northern basin of the lake. Fish densities in plume and reference areas differed seasonally. Densities typically differed by a factor of 2 to 4 although on one occasion plume area density was 90 times greater. Highest plume densities occurred during late spring when alewife (Alosa pseudoharengus) were spawning inshore. Consistently dense congregations of fish were found downstream of the interfaces between ambient shore-parallel currents and discharge flows. The general distribution of fish with depth was similar in all areas. Differences between plume and reference areas were related to the discharge type: at canal discharges fish tended to congregate inshore while at the offshore discharge they congregated in deeper zones. Fish also tended to occupy shallower depth strata in all plume areas. Positive correlation between fish density and increasing temperature was common at both plume and reference areas during all three seasons, but more frequent at plume areas. Temperature selected by fish in plume areas were 1 to 3°C higher than maximum ambient temperatures.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 56058, 56058, 56170, 56207, 57555, 58077, 58078, 58090, 58092, 58113, 58114, 58124, 58128, 58142, 58164, 58219, 58219, 58221

58245 (AD-A—110756/4) A plant bioindicator system for estimating pollution abatement - elucidation of the ultrastructural, physiological, and biochemical basis of sensitivity and tolerance to NO_2, SO_2, and O_3. Final report 1 July 1978-31 December 1981. Skelly, J.M.; Yang, Y. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 15 Jan 1982. 14p. NTIS, PC A02/MF A01.

The specific objectives of this research are: (1) to compare the stomatal frequency of two selected eastern white pine, one sensitive and one tolerant to O_3; (2) to characterize the fine structure of the epicuticular wax on needle surface and to compare the wax structure of the two selected clones; (3) to continue the determination of the relative sensitivity of selected eastern white clones to NO_2, SO_2, and O_3 used singly and in combination; (4) to investigate photosynthetic and respiratory rates of different eastern white pine clones during light and dark conditions as influenced by NO_2, SO_2, and O_3; and (5) to determine the influence of NO_2, SO_2, and O_3 fumigation on needle chlorophyll content. A summary of the most important results is given and papers produced by the participants are listed.

58246 (AD-A—110802/6) Forest tree growth as a bioindicator of pollution abatement systems at the Radford Army Ammunition Plant. Final report 1 Jul 76-30 Jun 78. Skelly, J.M.; Kress, L.W. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Plant Pathology and Physiology). 14 Jan 1982. 14p. NTIS, PC A02/MF A01.

The study objectives of this research were: (1) to determine if the pollution levels alone were responsible for the observed growth suppressions in trees growing at Radford Army Ammunition Plant (RAAP); (2) to screen several full-sib families of loblolly pine and half-sib families of American sycamore for tolerance or sensitivity to O3, SO2, and NO2; (3) to identify and quantify the effects to loblolly pine and sycamore of long-term low-level exposures to O3, SO2, and NO2 in combination; (4) to demonstrate the success or failure of the abatement programs now being initiated at the RAAP, with loblolly pine and/or American sycamore as bioindicators; and (5) to contribute to the field of air pollution effects on plants an understanding of the growth impact of pollutant interactions.

58247 (CONF-820122—8) Human serum teratogenicity studies using in vitro cultures of rat embryos. Klein, N.W.; Chatot, C.L.; Plenefisch, J.D.; Carey, S.W. (Connecticut Univ., Storrs (USA)). 1982. Contract AC02-76EV03139. 9p. NTIS, PC A02/MF A01. Order Number DE82020382.

From Symposium on the application of short-term bioassays in the analysis of complex environmental mixtures; Chapel Hill, NC, USA (25 Jan 1982).

Those conditions that constitute reproductive risks to man are being analyzed. Particular concern is with those conditions that cannot be or have not been identified by present methodologies. These conditions constitute the majority of factors causing fetal wastages and birth defects. The test system uses intact rat embryos that are cultured in vitro for 2 days. Findings to date suggest that this system may have a number of distinct advantages: (1) whole-embryo culture provides the test with the entire repertoire of processes involved in embryonic development; (2) whole-rat embryos can be cultured on high levels of blood serum; and (3) they can be cultured on serum from human subjects, which provides a direct and unique evaluation of the principal organism of concern. In regard to this last point, it is important to recognize that there is a large range of teratogenic responses and sensitivities to teratogens dependent upon both individual and species differences. (ERB)

58248 (DOE/EV/03139—46) Embryo culture in teratological surveillance and serum proteins in development. Progress report, 1981-1982. Klein, N.W. (Connecticut Univ., Storrs (USA). Dept. of Animal Genetics). Aug 1982. Contract AC02-76EV03139. 11p. (COO—3139-46). NTIS, PC A02/MF A01. Order Number DE82020443.

Major efforts have focused on three areas: the teratogenic effects of anticonvulsants and thalidomide in monkeys and rats; the teratogenic risks of occupational and environmental exposures as well as cigarette smoke on rat embryo cultures; and the use of rat embryo cultures to detect teratological and reproductive risks. (ERB)

58249 (LA—9113-MS) Long-term effects of intragastric instillations of Sylgard 184 encapsulating agent. Smith, D.M.; Drake, G.A.; London, J.E. (Los Alamos National Lab., NM (USA)). Dec 1981. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01. Order Number DE82007029.

Young male Sprague-Dawley rats (68 days old) were given a single dose [5 g/kg body weight (BW)] of Sylgard 184 encapsulating resin intragastrically (IG), and young female Swiss-Webster mice (87 days old) were given a single dose (5 g/kg BW) IG, or a dose (1 g/kg BW) IG on each of 5 consecutive days, of Sylgard 184 encapsulating resin. All animals were then maintained for the rest of their lives and autopsied at death.

58250 (PB—82-151309) Coal tar pitch sampling analysis. Final report. Coulter, P.D.; Petro, B.A. (Union Carbide Corp., Parma, OH (USA). Research Lab.). 14 Jul 1972. 146p. NTIS, PC A07/MF A01.

The abilities and efficiencies of sampling procedures and analytical methods are evaluated so that potential hazards associated with coking and roofing operations may be determined. Methods are presented for the determination of: benzene soluble material, polynuclear aromatic compounds, benzo(a)pyrene in airborne particulates, the composite emission index of volatile matter collected on air sampling filters and on glass fiber filters, trace metals in airborne particulates, and organic vapors. Methods are given for polynuclear aromatics using gas chromatography and ultraviolet spectrophotometry, and liquid chromatography and spectrophotometry, after different extraction techniques. Modifications, improvements, and drawbacks to the methods are noted.

58251 **(PB—82-152208) Inhalation toxicity study of nitrous oxide and halothane in rats. Final report.** (Hazleton Labs. America, Inc., Vienna, VA). 24 Feb 1977. 46p. NTIS, PC A03/MF A01.

The mutagenic potential of long-term exposure of 120 male Sprague-Dawley rats to nitrous oxide is measured by observing aberrations in bone marrow cell chromosomes. Forty rats serve as controls, 40 are exposed to 50 ppm nitrous oxide plus 1 ppm halothane, and 40 are exposed to 500 ppm nitrous oxide plus 10 ppm halothane, for 7 hours a day, 5 days a week for 52 weeks. The most frequently found aberration is the chromatid gap. There is a significant increase in the number of gaps and this increase is dose-related. Chromatid breaks are the next most frequent aberrations observed. Chromosomal breaks are comparable among all groups. Chromosomal markers are significantly increased in the group receiving 500 ppm nitrous oxide. The incidence of polyploidy is comparable among control and treated groups. Fifty-nine percent of the animals in the first treatment group show aberrant cells; 68% in the second treatment group. It is concluded that exposure to 500 ppm nitrous oxide plus 10 ppm halothane can cause chromosomal damage to bone marrow cells in the rat.

58252 **(PB—82-152216) The development and evaluation of an electronic emission spectral index which can be related to the carcinogenic hazard of the respirable portion of coal-tar pitch volatiles. Final report 1 Jun 71-31 May 72.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1972. 157p. NTIS, PC A08/MF A01.

The possibility of relating an electronic emission spectral index to the carcinogenicity of respirable portions of coal-tar pitch volatiles is investigated. Photophysical properties are determined for 34 polynuclear aromatic hydrocarbons and their heterocyclic analogs. Statistical analysis of the results indicates that there is no significant correlation, with the exception of fluorescence lifetimes, between these properties and the known carcinogenic activity of the compounds studied. An electronic emission spectral index for carcinogenic hazards based on these photophysical properties does not exist for the compounds studied. An index based on fluorescence lifetimes could potentially be used to evaluate the carcinogenic hazard of an untested pure compound, but such an index would not be applicable to mixtures. Testing the photodynamic activities of the compounds using the crustacean Artemia salina shows good statistical correlation between photodynamic activity and carcinogenicity. This method, although untested on mixtures, should be applicable to air samples and other polynuclear aromatic mixtures.

58253 **(PB—82-158544) The health effects of coal-burning power plants in minnesota.** Ross, D. (Minnesota Public Interest Research Foundation, Minneapolis (USA)). 1981. 54p. NTIS, PC A04/MF A01.

The carcinogenic properties of coal combustion products are described and documented with emphasis on beryllium, mercury, and other particulates. Increased coal use in Minnesota and implications of such increases for 1976-1995 are discussed. Details of how a coal-fired power plant works and how pollutants are formed are described. Efforts to minimize health impacts of sulfur oxides and particulates are detailed. An analysis is provided of how health impacts are measured, showing how a lack of precision and data makes it difficult for policymakers to decide which pollutants need regulation and how much regulation is required. It was found that the greatest problem resulting from coal burning in Minnesota is fine particulate pollution. Fine particulates have been implicated in the exacerbation of emphysema, bronchitis, and lung cancer. Increased regulation and limitations on the construction of coal burning electricity generators are supported.

58254 **(PB—82-161282) Acrolein health effects. Final report.** Carson, B.L.; Beall, C.M.; Ellis, H.V. III; Baker, L.H.; Herndon, B.L. (Midwest Research Inst., Kansas City, MO (USA)). Sep 1981. 128p. NTIS, PC A07/MF A01.

Health effects literature primarily related to inhalation exposures to acrolein was collected, evaluated, tabulated, and summarized. Approximately 125 documents were collected from computerized and manual literature searches covering the period 1911-1981. Pharmacologists and an M.D. epidemiologist rated the documents according to their applicability to the study and their methodology. The approximately 45 documents considered useful for deriving a range of concern for human exposure to acrolein from automotive emissions were tabulated. The pages of tables detail the results of acute, repeated dose, and chronic testing of mice, hamsters, rats, guinea pigs, chickens, rabbits, cats, monkeys, dogs, and humans as well as human occupational and accidental studies. Most of the documents evaluated are described in an annotated bibliography.

58255 **(PB—82-162397) Formaldehyde health effects. Task 5 report (final).** Carson, B.L.; McCann, J.L.; Beall, C.M.; Baker, L.H.; Ellis, H.V. III. (Midwest Research Inst., Kansas City, MO (USA)). 21 Dec 1981. 270p. NTIS, PC A12/MF A01.

Health effects literature primarily related to inhalation exposure to formaldehyde was collected, evaluated, tabulated, and summarized. Approximately 425 documents were collected from computerized and manual literature searches covering the period 1905-1981. Pharmacologists and an M.D. epidemiologist rated the documents according to their applicability to the study and their methodology. The approximately 110 documents considered useful for deriving a range of concern for human exposure to formaldehyde from automotive emissions were tabulated. The 145 pages of tables detail the results of acute, repeated dose, and chronic testing of mice, hamsters, rats, guinea pigs, rabbits, cats, pigs, dogs, monkeys, and humans as well as human occupational and epidemiological studies. Most of the documents evaluated are described in an annotated bibliography.

58256 **(PB—82-164849) Cytogenetic evaluation of bone marrow cells in the rat following long term inhalation exposure to nitrous oxide plus halothane. Final report.** (Hazleton Labs. America, Inc., Vienna, VA). 1970. 27p. NTIS, PC A03/MF A01.

The mutagenic potential of long-term exposure of 120 male Sprague-Dawley rats to nitrous oxide is measured by observing aberrations in bone marrow cell chromosomes. Forty rats serve as controls, 40 are exposed to 50 ppm nitrous exide plus 1 ppm halothane, and 40 are exposed to 500 ppm nitrous oxide plus 10 ppm halothane, for 7 hours a day, 5 days a week or 52 weeks. The most frequently found aberration is the chromatid gap. There is a significant increase in the number of gaps and this increase is dose-related. Chromatid breaks are the next most frequent aberrations observed. Chromosomal breaks are comparable among all groups. Chromosomal markers are significantly increased in the group receiving 500 ppm nitrous oxide. The incidence of polyploidy is comparable among control and treated groups. Fifty-nine percent of the animals in the first treatment group show aberrant cells; 68% in the second treatment group. It is concluded that exposure to 500 ppm nitrous oxide plus 10 ppm halothane can cause chromosomal damage to bone marrow cells in the rat.

58257 **(PB—82-164872) Results of the controlled exposure of human females to the vapor of methylene chloride.** Hake, C.L.; Stewart, R.D.; Forester, H.V.; Lebrun, A.J.; Peterson, J.E. (Medical Coll. of Wisconsin, Milwaukee (USA). Dept. of Environmental Medicine). Mar 1974. 25p. NTIS, PC A02/MF A01.

The results of controlled exposure of human females to the vapor of methylene chloride (75092) are presented to supplement a previous comprehensive study of the effects of industrial exposure levels on male human subjects. The data obtained for nine healthy, volunteer human females, aged 20 to 41 years, concerned details of their general health and smoking habits, carboxyhemoglobin (COHb) levels, blood tests, EKG's urinalyses, and behavioral performances during and after the experiment. None of the subjects were exposed to abnormal levels of carbon monoxide (CO) (630080). Another report will cover the breath decay curves obtained during this study. The subjects completed subjective response forms at hourly intervals, noting any physiological reactions or symptoms. Neurological, behavioral and medical tests revealed no deleterious effects on the subjects. The determination of blood COHb saturation is considered to be a very accurate measure both of CO exposure and of the metabolization of methylene chloride to CO; so it is not recommended for monitoring industrial exposures to methylene chloride vapors where there is the possibility of low levels of CO in the atmosphere.

58258 **(PB—82-182536) Health hazard evaluation report No. HETA-81-054-1010, Environmental Protection Agency, San Francisco, California.** Belanger, P.L.; Okawa, M.T. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Dec 1981. 11p. NTIS, PC A02/MF A01.

In February 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from a representative of the Environmental Protection Agency workers, Local No. 1 of the National Federation of Federal Employees. The requestor was concerned that employees working on the fifth and sixth floors at 215 Fremont Street, San Francisco, CA., may be exposed to street level vehicle exhausts entering the intake ventilation system located on the rooftop. It was reported that diesel fumes were smelled occasionally during the day. Several workers were reported to complain of headaches, stuffy nose and upper respiratory irritation. Also, there were complaints that an improperly operating ventilation system caused overheating or overcooling which prolonged workers colds and sore throats.

58259 **(PB—82-184573) Health hazard evaluation report No. HHE-80-195-811, Elco Corporation, Connector Division, Huntingdon, Pennsylvania.** Conover, D.L.; Chronstek, W.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Feb 1981. 14p. (HHE—80-195-811). NTIS, PC A02/MF A01.

Personal air samples were analyzed, radiofrequency (RF) radiation was measured and employees were given medical questionnaires at Elco Corporation (SIC-3678) in Huntingdon, Pennsylvania on September 5 and November 5 and 6, 1980. Employees of Elco Corporation requested the evaluation due to their concern that RF or ultraviolet radiation was causing eye and skin irritation, nausea and scalp lumps. Of the 450 employees at the facility only 5 were exposed to RF radiation. Measurements of electric and magnetic field strengths were made for the eyes, neck, chest, waist, gonads, knees, ankles and hands. None of the RF measurements exceeded the OSHA standards of 40,000 square volts per square meter and 0.25 square amperes per square meter. Air samples contained concentrations of hydrogen-chloride (7647010) below the limit of detection and ozone (10028156) concentrations to 60 micrograms per cubic meter, below the OSHA standard of 200 micrograms per cubic meter. Medical questionnaires of five employees revealed one with eye irritation, two with skin irritation, one with sore throat and one with a heart problem. The authors conclude that a hazard does not exist due to RF radiation exposure. Problems due to infrared, ultraviolet and visible light may have caused skin and eye complaints; these problems were rectified by installation of a darkened plastic shield. Recommendations include shielding and tuning of machines, use of proper procedures during maintenance, and an increase in distance between worker and RF source.

58260 **(PB—82-184649) Health hazard evaluation report No. HHE-80-233-793, Davis Bessie Nuclear Power Station, Toledo Edison Company, United Engineers and Contractors Company (UE and C), Oak Harbor, Ohio.** Cone, J.; Hartle, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Jan 1981. 14p. (HHE—80-233-793). NTIS, PC A02/MF A01.

Personal air samples were analyzed and employees were given medical evaluations at Davis Bessie Nuclear Power Station (SIC-4911) in Oak Harbor, Ohio. Requests for evaluation were made by a union representative of the United Engineers and Contractors and a union representative of employees of Toledo Edison Company, working on site at the power station, to evaluate employee skin and scalp problems due to exposure to ceramic wood fibers. Preliminary surveys were conducted on September 24 and 25, 1980 and a follow-up survey was performed on October 16, 1980. Environmental evaluation consisted of gravimetric analyses of personal air samples for airborne ceramic wool fibers. A total of 400 production and maintenance workers and varying numbers of construction workers were exposed to the fibers during installation of insulation which was completed at the time of the survey. The three personal air samples showed no accumulation of particulates and fibers detected were nonrespirable. Medical evaluations were conducted in 52 workers and scalp scrapings were obtained from 43 workers. Thirty seven workers had histories suggestive of irritant dermatitis of the scalp; 24 workers had physical findings consistent with the diagnosis. Of the 43 scalp samples, 18 were contaminated with organisms of the gut, perineum, skin or respiratory tract. Dermatitis was directly related to the history of dust exposure. The authors conclude that a potential health hazard exists for employees from exposure to ceramic wool fiber. Recommendations include provision of handwashing facilities and protective clothing for employees, and installation of an impermeable covering for the ceramic wool fiber.

58261 **(PB—82-192709) Development of a biological screening method to detect potential exposure of synfuel plant workers to carcinogenic substances. Final report.** Hannan, M.A.; Recio, L.; Enoch, H.G.; Hill, R.H. (Kentucky Dept. of Energy, Lexington (USA)). Nov 1981. 84p. NTIS, PC A05/MF A01.

The purpose of this project was to determine the feasibility of using the Ames assay as a biological monitoring tool to evaluate exposure to mutagens/carcinogens, which may be possibly generated by a synfuel plant. Phase I of this project consisted of analyzing urine samples of cigarette smokers and non-smokers for mutagenicity in order to establish that this assay can reproducibly detect mutagens present in smokers' urine, as well as to distinguish smoking-related mutagenic urine samples from work-related ones. This was necessary to develop a standardized protocol for urine screening. Phase II consisted of an extension of Phase I to examine mutagen activity as cake-oven workers, exposed to known carcinogens and known to have increased cancer risks. Phase II consisted of an analysis of mutagenic activity in urine samples from volunteer workers at the H-coal pilot plant at Catlettsburg, Ky.

58262 **(PB—82-915000) TOX-TIPS. Monthly reports.** (National Library of Medicine, Bethesda, MD (USA). Toxicology Information Program). 1982. vp. Paper copy available on subscription, North American Continent price $40.00/year; all others write for quote. Single copies also available.

TOX-TIPS results from a cooperative effort to prevent the duplication of toxicity testing programs and epidemiology studies to determine toxic risks of chemical substances and other agents. Input to TOX-TIPS is submitted on Science Information Exchange (SIE) Notice of Research Project forms included in each TOX-TIPS issue. Prompt reporting of new projects to the Editor, TOX-TIPS reduces the chances of duplication as material is usually printed in the first issue scheduled after its receipt. After the project description and related data are published, the information is relayed to SIE for inclusion in that national database of information on research-in-progress. Inquiries and requests for sample issues of publications should be directed to the EDITOR, TOX-TIPS at the National Library of Medicine. Subscription activities are managed by the National Technical Information Service which should be contacted directly.

58263 (UCRL—87003) Extrapolation of mutagenicity testing to the human. Mendelsohn, M.L. (Lawrence Livermore National Lab., CA (USA)). 8 Dec 1981. Contract W-7405-ENG-48. 7p. (CONF-811156—2). NTIS, PC A02/MF A01. Order Number DE82006744.

From Symposium on genetic toxicology: an agricultural perspective; Davis, CA, USA (1 Nov 1981).

The concept of mutagen testing is discussed in terms of the ability to extrapolate data from non-human test samples to mutagenic potential in humans. The question of the correlation between mutagenesis and carcinogenesis is also discussed. (ERB)

58264 Blood carbon monoxide levels in persons 3 to 74 years of age: United States, 1976-1980. Radford, E.P. (Univ. of Pittsburg, PA); Drizd, T.A. *Advance Data from Vital and Health Statistics;* No. 76, 1-24(17 Mar 1982). Contract AC02-77EV04552.

This report presents national estimates of the distribution of carbon monoxide levels in the blood of persons ages 3 to 74 years in the United States by age, smoking status, race, urbanization status of residence, annual family income, and season of the year. These findings will be described and analyzed further in a report in the Vital and Health Statistics series (in preparation). In this report the relative contributions of the four principal sources of carbon monoxide (smoking, ambient or outdoor exposures, occupational exposures, and indoor exposures) to COHb levels are examined. Of these, smoking is the most significant and widespread, although in special circumstances each of the other contributors assumes some importance.

58265 Structure-mutagenicity analysis with the CHO/HGPRT system. Hsie, A.W. (Oak Ridge National Lab., TN). *Food and Cosmetics Toxicology;* **19**: 617-621(1981). Contract W-7405-ENG-26.

Using a mammalian cell gene mutational assay, the Chinese hamster ovary cell/hyposanthine-guanine phosphoribosyl transferase (CHO/HGPRT) system, we have studied the structure-mutagenicity of ten alkylating agents and six platinum(II) chlorammines. In analyzing the mutagenesis data, we describe the mutagenic activity as the number of mutants per 10^6 clonable cells induced by a 1 μM concentration of chemical tested. The mutagenicity of alkylating chemicals decreases with increasing size of the alky group; methylating agents are three to six times more mutagenic than the corresponding ethylating agents, cis-$Pt(NH_3)_2Cl_2$ is mutagenic, but its steric isomer, trans-$Pr(NH_2)_2Cl_2$, is very much less mutagenic. These results, together with determination of chemically induced DNA lesions permit analyses of certain aspects of mechanisms of chemical mutagensis.

58266 Statistical inconsistencies in the use of no-observed-effect levels in toxicity testing. Skalski, J.R. (Pacific Northwest Lab., Richland, WA). *American Society for Testing and Materials, Special Technical Publication;* No. 737, 377-387(1981).

Use of the no-observed-effect level (NOEL) as an experimental end point violates the principle of negative inference, the logical basis of statistical hypothesis testing. The NOEL is based on the nonrejection of the hypothesis of no toxic effect, whereas scientific methods stress conclusions based on the rejection of a hypothesis. Failure to reject this hypothesis may result either because the concentration is safe or because the experimental protocol to detect a toxic response is insensitive, but the cause is indeterminant and the error rate unknown. The lowest rejected concentration tested (LRCT) is recommended as an experimental end point. By the use of LRCT the rate of misclassification is known and is equal to α. Experimental designs that emphasize both the biological and the statistical significance of LRCT end points are recommended.

58267 Toxicity of Santa Barbara seep oil to starfish embryos. Part 1. Hydrocarbon composition of test solutions and field samples. Stuermer, D.H.; Spies, R.B.; Davis, P.H. (Lawrence Livermore National Lab., CA). *Marine Environmental Research;* **5**: 275-286(1981). Contract W-7405-ENG-48.

The composition and concentration of the water-soluble fraction (WSF) of four oils (Prudhoe Bay Crude, Holly Monterey Crude, Holly Rincon Crude and Isla Vista Seep Oil) are described. Changes in concentration and composition with exposure time in our bioassay chambers are described. Rapid concentration decreases and an unusual compositional relationship point to the importance of performing chemical analyses in conjunction with bioassay experiments. Comparison of the chemical composition of dissolved hydrocarbons in seawater at the Isla Vista Seep Oil site with the WSF of the seep oil shows many similarities, although the concentration is lower than the WSF by approximately 1000-fold.

58268 Biological exposure sensors in coal-conversion technologies. Garrett, A.S. Jr. (Oak Ridge Natl Lab, TN). *American Society for Testing and Materials, Special Technical Publication;* No. 721, 166-170(1980). (CONF-790832—).

From 4. biennial Boulder symposium; Boulder, CO, USA (6 Aug 1979).

The health of employees involved in coal-conversion research at the Oak Ridge National Laboratory, Oak Ridge, Tennessee, is assessed in a broad program of surveillance, which includes testing aimed at evaluation of general health, as well as special attention to the lungs and skin because of their potential for exposure to carcinogens. Included are sputum cytology for the detection of premaglignant change and dermatologic examinations, aided by a review of prior photographs. The expansion of surveillance into areas of enzyme and metabolite assessment is anticipated to expand our battery of biological sensors. 7 refs.

58269 Significance of low molecular weight, metallothionein-like proteins in marine invertebrates: current status. Roesijadi, G. (Battelle Pacific Northwest Labs., Sequim, WA). *Marine Environmental Research;* **4**: 167-179(1980).

Low molecular weight, metal-binding proteins have been shown to occur in several marine invertebrate species. The molecular weights, metal contents, and induction of these proteins by metals such as cadmium, zinc, copper, and mercury suggest close similarities to metallothionein, a sulphydrl-rich, metal-binding protein of widespread occurrence in vertebrates. Metallothionein has, to date, been identified in two species of brachyuran crabs. The identity of the protein in other marine invertebrate groups such as molluscs is still to be determined. Continued study of the metal-binding proteins will undoubtedly contribute to our understanding of both the normal metabolism and toxicology of certain trace metals in marine species. It appears that these proteins may be involved in the sequestration and detoxification of metals. Organisms which have been exposed to metals such as cadmium, zinc, copper, or mercury in the laboratory or field exhibit enhanced levels of metals which are associated with the metal-binding proteins. Additional studies will be required in order to determine the biochemical and physiological significance of such bound metals.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 58259

58270 (EPRI-CS—2477) Feasibility study of chemical detoxification of polychlorinated biphenyl capacitors. Phase I study. Final report. Miille, G.J.; Weitzman, L. (Acurex Waste Technologies, Inc., Mountain View, CA (USA)). Jun 1982. 87p. NTIS, PC A05/MF A01. Order Number DE82906427.

Portions of document are illegible.

Chemical detoxification of polychlorinated biphenyl (PBC) using sodium metal reduction is emerging as a significant new method of destroying PCB liquids. The results of a preliminary study on chemical detoxification as it applys to PCB's in capacitors are reported. The results of the first phase of a two-phase study are presented to evaluate the possibility of chemical processing of PCB capacitors. Phase I consists of the following tasks: literature search, acquisition of EPA permits for PCB research, evaluation of the legal and regulatory requirements of this process, design specialized equipment for handling PCB capacitors in the laboratory, and design Phase II research program. Phase II tasks are described. The results of the first-phase program were very encouraging. Based on available information, it appears possible to chemically destroy PCB's in capacitors. This report identifies questions that must be answered by the Phase II (laboratory) program before the feasibility of such an operation can be determined. Finally, this report describes a research program that must be followed to answer the previously mentioned questions, and to develop the design data for a full-scale capacitor treatment system.

58271 **(PB—82-168360) Evaluation and abatement of noise from aircraft auxiliary power units and airport ground power units. Technical report (final).** Staiano, M.A.; Samis, R.A.; Toth, S. (ORI, Inc., Silver Spring, MD (USA)). 7 Oct 1980. 100p. NTIS, PC A05/MF A01.

APUs and GPUs provide essential service to aircraft during ground operations. Sound levels near these devices range from 80 to 87 dBA at 30 m for APUs, 83 to 103 dBA at 10 m for turbine-engined GPUs, and 71 to 80 dBA at 10 m for piston-engined GPUs. Procedures are provided for: (1) estimating community sound levels due to APUs and GPUs, (2) estimating their exposures in terms of day-night sound levels, and (3) assessing the desirability of noise abatement by comparison to recommended levels for acceptability. Noise abatement options include: operational changes, equipment movement, equipment substitution, equipment quieting, and sound barrier usage.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 58101

58272 **An alternative to ecologic regression analysis of mortality rates.** Selvin, S. (Univ. of California, Berkeley); Merrill, D.; Sacks, S.T. *American Journal of Epidemiology;* **115**: No. 4, 617-623(Apr 1982). Contract W-7405-ENG-48.

A number of recent papers have used geographically defined data and linear models to study the relationship between a series of epidemiologic factors and the frequency of disease. This "ecologic regression" approach involves serious problems of interpretation. An alternate approach is discussed that does not depend on statistical models, produces easily interpreted results and yields statistical summaries that approximately parallel regression analysis. This alternative procedure is illustrated by using acute lymphocytic leukemia mortality data on a county level from among white females less than five years of ages between 1969-1977.

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 57585

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 56152, 56303, 56342, 56343, 56344, 56345, 56674, 57020, 58049, 58146, 58165, 58167

58273 **(CEA-N—2237) Relationships between environment and characteristics of marine Fe-Mn deposits in the Romanche trench.** Bonte, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Electronique Physique). Nov 1981. 260p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE82702352.

Thesis.

The geological characteristics and Fe-Mn deposits from the North wall of the Romanche trench (Atlantic ocean) were studied in order to investigate possible relationships of these deposits with hydrothermalism. The results indicate diffuse hydrothermal activity in all of the rock samples which may explain the notable mineralogical associations observed, such as talc-dolomite-hematite-serpentine. All rock outcrops were covered with Fe-Mn deposits, but no such deposits were noted on sedimentary platforms. The variations in average chemical composition are very low among the different deposits. Hence, the phenomenon which produces these deposits is not localized. From this study, we conclude that marine Fe-Mn deposits result from the continuous supply of terrigenous iron and discontinuous supply of manganese, probably hydrothermal in origin. Detrital particles and numerous chemical elements are scavenged during the accretion process itself, whereas some trace elements, among the least soluble (Co, Ti, Th, Ce), are adsorbed on these deposits, independently of the accretion. This explains the inverse variation of the content of these elements versus deposit thickness.

58274 **(SAND—82-0770) Bibliography of geology of Southeastern New Mexico.** Shaffer, S.E. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1982. Contract AC04-76DP00789. 156p. NTIS, PC A08/MF A01. Order Number DE82016408.

This volume is composed of 1464 geological citations cross-indexed by subject and author. A reference map is included.

58275 **Dating of obsidian artifacts by depth-profiling of artificially hydrated surface layers.** Tsong, I.S.T.; Smith, G.A.; Michels, J.W. (Pennsylvania State Univ., University Park (USA)); Wintenberg, A.L.; Miller, P.D.; Moak, C.D. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **191**: No. 1-3, 403-407(31 Dec 1981).

From 5. international conference on ion beam analysis; Sydney, Australia (16 - 20 Feb 1981).

Fresh surface of obsidians are hydrated in the laboratory and the thicknesses of the hydrated layers are determined by hydrogen depth-profiling using secondary ion mass spectrometry (SIMS) and ^{19}F nuclear reaction. From our results, we conclude that it is feasible to establish a hydration equation which will allow obsidian artifacts to be independently dated by their hydrated depths. However, it is important to operate in hydration time and temperature regimes in which dissolution of the obsidian surface can be avoided.

5802 Geophysics

REFER ALSO TO CITATION(S) 56331, 56341, 56947, 58049, 58050, 58127

58276 **(FOA-C—20431-T1) Common data base experiment: progress report on data analysis.** Barkeby, G.; Bergkvist, N.O.; Dahlman, O.; Johansson, P.; Ohlsson, H.; Roy, F. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Nov 1981. 73p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82904738.

Portions of document are illegible.

The purpose of the Common Data Base Experiment (CDBE) was to create a common comprehensive and high quality seismic data base from a large number of globally distributed stations. This data base is to be used to study various issues connected to the establishment of an international verification system for a CTB and especially the functions at International Data Centers. This report summarizes the results obained so far at the temporary data center facilities at the National Defence Reseach Institute in Stockholm. The analyzed data were collected during a two weeks period in October 1980 with the contribution of bulletins, so called level I data, from 59 stations in 21 countries and waveform data, so called level II data, from 58 stations in 13 countries. The results presented here are far from being complete and must be treated as preliminary.

58277 **(NUREG/CR—2484) Geophysical investigations of the western Ohio-Indiana region. Technical report (final) Nov 75-Sep 81.** Jackson, P.L.; Christensen, D.H.; Mauk, F.H. (Michigan Univ., Ann Arbor (USA)). Jan 1982. 178p. NTIS, PC A09/MF A01.

The geophysical investigations of the Western Ohio and Indiana regions include the maintenance of a precision seismograph network to monitor earthquake activity. Data generated by this network, supplemented with other information, are used to analyze regional seismicity and to interpret the local geologic and seismotectonic structure. Four array stations in Indiana were added to the nine stations near Anna, Ohio, and the Ohio stations were upgraded by replacing seismometers and installing more stable electronic systems. A new digital computer with analog-to-digital convertors was obtained for direct digital recording and other digital analysis. Ten small earthquakes in the Anna region were recorded, six in a very tight cluster near the village of Anna. Only one of the earthquakes was felt. P-wave studies show an azimuthally dependent difference in residuals between stations within the Western Ohio array--a difference which can only be caused by significant variation in local structure. Aftershocks were recorded, public responses obtained and classified, and intensity contours drawn for the 5.1 magnitude earthquake on July 27, 1980, in Sharpsburg, Kentucky.

58278 **In situ stress field in the southeastern United States and its implication.** Stephenson, D.E. (E.I. du Pont de Nemours & Co., Aiken, SC); Pratt, H.R. *Southeastern Geology;* **22**: No. 3, 115-121(Aug 1981). Contract AC09-76SR00001.

Published and unpublished in situ stress measurements and studies of earthquake focal mechanisms in the southeastern United States provide useful information on the relative magnitude and orientation of existing stress fields in the region. These data provide general agreement with the complex geology and the present-day tectonic processes observed in many areas of the southeastern United States. Stress measurements reveal the existence of high horizontal stresses in the Appalachian complex. The magnitude of the maximum horizontal stress ranged from 3.4 to 41.8 MPa. Different in situ stress states in the Appalachian complex, the Coastal Plain, and the stable interior region indicate the possibility for different faulting mechanisms. Data derived from the various techniques for determining in situ stress are consistent within the data scatter in each province.

58279 **Attenuation of shear-waves in the lithosphere for frequencies from 0.05 to 25 Hz.** Aki, K. (Massachusetts Inst. of Tech., Cambridge). *Physics of the Earth and Planetary Interiors;* **21**: 50-60(1980).

Q for shear-waves in the crust and upper mantle was determined as a function of frequency in the range 1 to 25 Hz, using band-pass filtered records of about 900 earthquakes occurring in the central Japan area with focal depths from 0 to 150 km. The data were supplied from two stations in the Kanto region, operated by the Earthquake Research Institute, University of Tokyo. The method is taken from Aki and Chouet and Rautian and Khalturin, and is based on elimination of the source effect from observed spectra of shear-waves, by taking the ratio of their amplitudes to those of coda-waves. The effect of radiation patterns is removed by averaging the ratio over many events. The experimental procedure uses basically a single-station method, and its validity was confirmed by the agreement between results obtained from station Tsukuba and those from Dodaira. Researchers found that Q shows a strong dependence on frequency: Q increases with frequency f proportionally to f/sup n/, where n was found to be 0.8 in the northeastern part of Kanto, and 0.6 in the rest of the region. Previously, a value for n of 0.5 had been determined for the Garm area in central Asia by Rautian and Khalturin. In general, our results agree with those of Fedotov and Boldyrev, who obtained values of n around 0.6 for the Kuril-Islands, using a single-station method based on assumptions more restrictive than those adopted here. Q values for the lithosphere have been estimated by various workers using surface-waves with periods greater than 15 s. If we combine the results from surface-waves with those obtained from the S- to coda-amplitude ratio, we find that the frequency-dependence of Q^{-1} is similar to that obtained from a simple relaxation model, with the peak somewhere around 0.5 Hz.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 56291, 56341, 56344, 56346, 56366, 56443

58280 **(AERE-R—10046) Physical properties of granite relevant to near field conditions in a nuclear waste depository.** McLaren, J.R.; Titchell, I. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Oct 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701555.

This report presents results of the effects of heat and time at temperature on Young's modulus of granite pertinent to fission product heating in a depository for radioactive waste. In general, modulus remains constant at approximately 65 GPa to 60 to 80°C and then falls in nearly linear fashion to approximately 6 GPa at 550°C. This effect is ascribed to cracking due to differential thermal expansion between the constituent minerals or between differently oriented crystals of the same mineral. An attempt has been made to quantify the extent of cracking and hence calculate an increase in surface area exposed of between 10^0 and 10^3 m^2/m^3 of rock by heating to 200°C. The effects of overburden pressure have not been studied.

58281 **(ENPU—80-13) Geomechanical properties of rocks from the Altnabreac area.** McEwen, T.J.; Horseman, S.T.; Lai, S.F. (Institute of Geological Sciences, London (UK); Natural Environment Research Council, London (UK)). Jun 1980. 81p. NTIS (US Sales Only), PC A05/MF A01; Available from Environmental Protection Unit, Institute of Geological Sciences, Harwell Laboratory, Oxfordshire. Order Number DE82702205.

Laboratory test results are presented for core samples of Strath Halladale Granite and Moine metasediments from the Altnabreac Research Site in Caithness, Scotland. Properties measured include indirect tensile strength, uniaxial compressive strength, shear strength under triaxial confinement, stress-strain parameters, density and porosity. Strength data are interpreted using Hoek and Brown's (1980) empirical failure criterion which is found to provide an adequate fit to the failure envelopes. The rocks at the site have been classified using Deere and Millers' (1966) engineering classification system for intact rocks.

58282 **Laboratory measurements of ultralow permeability of geologic materials.** Trimmer, D. (Earth Science Division, University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **53**: No. 8, 1246-1254(Aug 1982). Contract W-7405-ENG-48.

A new apparatus is described for determining permeability (water) in geologic materials as a function of confining pressure (to 200 MPa), pore pressure (to 25 MPa), and deviatoric stress (500—800 MPa). The samples are relatively large (0.15 m diameter x 0.28 m long) and may be intact or contain a single through-going fracture. Permeabilities of 10^{-11}—10^{-24} m^2 (10—10^{-12} D) may be measured, simultaneously, with electrical conductivity and acoustic velocity and amplitude. Crack closure is also monitored for the fractured samples. All experimental control and data-acquistion functions are performd by a microcomputer. A discussion of data-analysis techniques and typical data are also presented.

5804 Geochemistry

REFER ALSO TO CITATION(S) 58169, 58170

58283 **(DOE/ER/10412—T1) Thermally induced chemical migration in carbonate rocks. Final project report.** Papike, J.J. (State Univ. of New York, Stony Brook (USA). Dept. of Earth and Space Sciences). May 1982. Contract AC02-79ER10412. 19p. NTIS, PC A02/MF A01. Order Number DE82019096.

This investigation concerns the thermally induced transport of major, minor, and trace elements, and the use of rare earth elements (REE) as analogs for actinide element migration.

58284 **(ORNL—5874) Permeability of salt-crystal interfaces to brine.** Gilpatrick, L.O.; Baes, C.F., Jr.; Shor, A.J.; Canonico, C.M. (Oak Ridge National Lab., TN (USA)). Jun 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE82016580.

To investigate the movement of brine along grain boundaries in polycrystalline salt, measurements have been made of the radial flow of brine through the interface between cylindrical salt crystals under axial stresses to 140 bar and temperatures to 80°C. For constant conditions, the total flow of brine showed a linear dependence on the logarithm of time, and the reciprocal permeability increased linearly with time. Loss of salt from the interface by pressure solution effects was more than enough to account for the decrease in the apparent thickness of the interface (i.e., that which may be estimated for an interface of the same permeability formed by plane parallel surfaces). This apparent thickness, initially as large as 10 μm, decreased to as little as 0.2 μm with exposure to stress and flowing brine. It decreased quickly with sudden increases in axial stress and usually increased, though not reversibly, with decreases in stress. The rate of increase in the reciprocal permeability with time was roughly proportional to the stress and to the square of the hydraulic pressure drop. Assuming similar apparent thicknesses for the grain boundaries in polycrystalline salt, permeabilities are predicted that are quite consistent with the low values reported for stressed core specimens.

58285 **Concentration, vertical flux, and remineralization of particulate uranium in seawater.** Anderson, R.F. (Woods Hole Oceanographic Inst., MA). *Geochimica et Cosmochimica Acta;* **46**: No. 7, 1293-1299(Jul 1982).

Concentrations and fluxes of particulate U were measured throughout the water column at several locations in the Atlantic and Pacific Oceans with in situ filtration systems and sediment traps. The results indicate that dissolved U is fixed to particles in surface seawater. Organic matter appears to be the carrier phase. Formation of particulate authigenic U below the surface waters could not be detected. Authigenic U is remineralized within the bathypelagic layers at the open ocean sites studied. In the Panama Basin, an upwelling area with high biological productivity, remineralization of authigenic U in the deep sea is insufficient to produce a measurable concentration gradient between surface and deep waters within the mixing time of the oceans. Formation of authigenic U in the water column in areas such as the Panama Basin is not a significant sink for U on an ocean wide basis.

58286 **Interelement relationship in abyssal Pacific ferromanganese nodules and associated pelagic sediments.** Li, Y.-H. (Lamont-Doherty Geological Observatory, Palisades, NY). *Geochimica et Cosmochimica Acta;* **46**: No. 6, 1053-1060(Jun 1982).

By R-mode factor analysis and enrichment factor calculations, most of the elements in abyssal ferromanganese nodules and associated pelagic sediments (excluding common authigenic minerals like apatite, barite, opal and carbonates) are found to be preferentially concentrated in one of the following three major phases: aluminosilicates (e.g., Al, Si, Sc, Ga, Cr, Be, Na, K, Rb and Cs), Fe-oxides (e.g., Fe, P, S, V, Se, Te, As, B, Sn, U, Hg, Pb, Ti, Ge, Y, Zr, Nb, Pd, In, rare-earths, Hf, Th, Pa, Pu, Am, Ru and Bi), and Mn-oxides (e.g., Mn, Tl, Ag, Cd, Mg, Ca, Ba, Ra, Co, Ni, Cu, Zn, Mo, Sb and probably W). The specific association of elements with these three phases can be explained by the difference in chemical forms of elements in seawater and by fundamental differences in physiocochemical properties (e.g., the pH of zero point of charge and dieletric constant) of these three phases.

58287 **Concentration and pH dependence of calcium and zinc absorption by iron hydrous oxide gel.** Kinniburgh, D.G. (Univ. of Wisconsin, Madison); Jackson, M.L. *Soil Science Society of America Journal;* **46**: No. 1, 56-61(Jan 1982). CONTRACT AC02-76EV01515.

The specific adsorption of calcium (Ca) (pH 8.0) and zinc (Zn) (pH 5.5 and 6.5) by iron (Fe) gel in 1M $NaNO_3$ could be adequately described over three to five decades of concentration (c. 10^{-2}M to 10^{-7}M) by splitting the adsorption isotherm into one, two, or three regions and fitting the Freundlich isotherm to each region separately. Over the range of concentrations, $10^{-4}M < c < 10^{-2}M$, Zn adsorption at pH 6.5 was about 10 times greater than at pH 5.5. Zinc adsorption at pH 5.5 was about the same as Ca adsorption at pH 8.0. No adsorption maxima were found. At trace concentrations ($c < 10^{-7}M$) where the adsorption isotherm is linear, adsorption (x/m) may be described by the equation: $\log (x/m) = \log k_1 + n^*pH + \log c$, where k_1 and n^* are empirical constants derived from percent adsorption against pH data. Estimates of $\log k_1$ and n^* for trace adsorption of Ca, Sr, Ba, Co, Cu, Zn, Cd, Ag, Y, and Ce were derived from various sources. Naturally occurring iron oxides (and other hydrous oxides) could exert a significant control on Zn concentrations in soil solutions above about pH 6.0.

58288 **Rare-earth and other trace-element distributions in the calc-alkaline volcanic rocks from deep boreholes in the Phlegrean Fields, Campania (South Italy).** Albini, A. (CISE, Milano, Italy); Cristofolini, R.; Di Girolamo, P.; Stanzione, D. *Chemical Geology;* **28**: No. 1/2, 123-133(1980).

Lavas and other volcanic products have been found in boreholes at depths of 300 to 1900 m, in Campania. They underlie the volcanics of the potassic and highly potassic sequence of this region, and show geochemical and mineralogic features similar to those of the K-rich calc-alkaline volcanics. Five of these rocks, ranging from basalts to basaltic andesites and andesites, have been analyzed for REE and other trace elements; only REE have been determined in six other more altered rocks. The geochemical data for these rocks agree with their petrology, and are similar to those of the calc-alkaline volcanics found along continental margins, and also of some products of the active volcanic area in the Eolian Islands. The petrography and the major- and trace-element chemistry of these rocks show that they reached different fractionation stages (SiO_2 = 48 to 60%; SI = 33 to 20; Cr = 80 to 18 ppM; Ce = 15 to 44 ppM), but not along one definite line of descent, the rocks having probably been produced from slightly different parent magmas.

5805 Oceanography

REFER ALSO TO CITATION(S) 58286

58289 **A bottom water intrusion in Onslow Bay, North Carolina.** Hofmann, E.E. (North Carolina State Univ., Raleigh); Pietrafesa, L.J.; Atkinson, L.P. *Deep-Sea Research, Part A: Oceanographic Research Papers;* **28A**: No. 4, 329-345(1981). Contract AS09-76EV00902;AS09-76EV00889.

During the period 20 July to 8 August 1976, a bottom intrusion of Gulf Stream water was observed in hydrographic data and data from moored current meters from Onslow Bay, North Carolina. The event was the result of southerly winds (upwelling favorable) and Gulf Stream meandering. Offshore (easterly) movement of the Gulf Stream causes an upward movement of isotherms which presents cold, saline water at the shelf break. Once this water is present at the shelf break, some other mechanism, such as southerly winds, is necessary for it to upwell into Onslow Bay. The extent of the upwelling is determined by the intensity and duration of the wind event.

64 PHYSICS RESEARCH

58290 **(KFTI—78-46) Technique of physical experiment.** (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1978. 76p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780649.

Individual papers in scope for the data base were entered separately.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 58634, 58638

58291 **(AD-A—109806/0) Role of the big flare syndrome in correlations of solar energetic proton fluxes and associated microwave burst parameters. Environmental research papers.** Kahler, S.W. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 21 Sep 1981. 33p. (AFGL-TR—81-0280; AFGL-ERP—754). NTIS, PC A03/MF A01.

In previous studies correlating E > 10 MeV proton fluxes and spectra with various associated microwave burst parameters, the resulting high correlations were assumed to reflect a common acceleration process for the protons and the microwave-emitting electrons. We suggest and test an alternative explanation for these correlations, which we term the Big Flare Syndrome (BFS), that states that, statistically, energetic flare phenomena are more intense in larger flares, regardless of the detailed physics. Peak 1-8 A X-ray fluxes, characteristic of the thermal flare, are correlated with peak proton fluxes to derive correlation coefficients characteristics of the BFS. Of all microwave parameters tested for the 1973-1979 period, only the time-integrated flux densities at 8800 and 15400 MHz may be significantly larger than expected form the BFS. We fail to confirm previous results associating peak proton spectra with peak microwave spectral characteristics, thus finding no evidence that peak microwave fluxes are indicative of proton acceleration. We extend this conclusion to peak hard X-ray correlations. The strongly nonlinear relationship deduced between flare energy and proton production also appears invalid.

58292 (AD-A—110098/1) **Numerical studies of gravitational accretion from x-ray heated stellar winds. Doctoral thesis.** Lupo, J.A. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Dec 1981. 153p. NTIS, PC A08/MF A01.

We present three numerical models of accretion from radiation driven stellar winds onto compact objects in massive X-ray binary systems. The wind is given a velocity profile consistent with a radiatively driven wind, and a 'negative mass' gravitational potential is derived from this profile to represent the wind driving force in the hydrodynamic equations. An X-ray heating model is used which determines the X-ray heating time from the Compton heating time and the known steady state energies for optically thin gas illuminated by X-rays. This allows X-ray heating to be included in the hydrodynamic equations. The X-ray luminosity is held proportional to the accretion rate, assuming that the gravitational potential energy released is equivalent to 10% of the infalling rest-mass energy. A two-dimensional Eulerian computer code is used to solve the equations of motion. Model estimates of the ionization structure, accretion rates and flow characteristics, and the effects of thermal instabilities are discussed. The impact of the X-ray radiation on the wind driving force is demonstrated. Results indicate a possible mechanism for slow X-ray flares, such as observed in 4U1700-37.

58293 (AD-A—111360/4) **Electron densities in a solar flare derived from x-ray spectra. Technical report.** McKenzie, D.L.; Broussard, R.M.; Landecker, P.B.; Rugge, H.R.; Young, R.M. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 15 Jan 1982. 19p. (TR—0082(2940-01)-1). NTIS, PC A02/MF A01.

We obtained high resolution solar x-ray spectra during the rising phase of a major solar flare between 0807 UT and 0905 UT on 1979 June 10. Measurements of the density sensitive line ratio, R, of the O VIII 1s squared (1) sub 0 - 1s 2s (3) S sub 1 (22.10 A) flux to the O VII 1s squared (1) S sub 0 - 1s 2p (3) P sub 1 (21.80 A) flux indicates that the density of the plasma at around 2 million K exceeded 10 to the 11th power per cu cm near the peak of the flare.

58294 (CEA-CONF—6027) **Acceleration of galactic cosmic rays in shock waves.** Lagage, P.O. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de la Physique). Jun 1981. 4p. (In French). (CONF-8106224—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702010.

From La Baume Sainte Marie meeting; Aix-en-Provence, France (10 Jun 1981).

The old problem of the origin of cosmic rays has triggered off fresh interest owing to the discovery of a new model which enables a lot of energy to be transferred to a small number of particles on the one hand and the discovery of the coronal environment in which this transfer occurs, on the other. In this paper, interest is taken in the galactic cosmic rays and an endeavour is made to find out if the model can reveal the existence of cosmic rays over a wide energy range. The existence of an energy break, predicted by the model, was recognized fairly early but, in the literature, it varies from 30 GeV to 10^6GeV according to the authors. A study has been made of the two main causes of an energy break: the sphericity of the shock and the life time of the shock wave.

58295 (CEA-CONF—6030) **Spectral observation of the soft x-ray background and of the north polar spur with solid state spectrometers.** Rocchia, R.; Arnaud, M.; Blondel, C.; Cheron, C.; Christy, J.C.; Ducros, R.; Koch, L.; Rothenflug, R.; Schnopper, H.W.; Delvaille, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de la Physique). Jun 1981. 5p. (CONF-8106229—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702258.

From 15. ESLAB symposium on x-ray astronomy; Amsterdam, Netherlands (22 Jun 1981).

In this paper, we present spectral measurements of the soft X-ray ($E < 1$ keV) background obtained with 3 cooled Si (Li) solid state detectors during the flight of a spin-stabilized rocket.

58296 (IN2P3—80-9-Vol.1) **Grand unified theories and their cosmological consequences.** Barloutaud, R.; Cavaignac, J.F.; Nanopoulos, N. (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)). Sep 1980. 122p. (In English and French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82903810.

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These lectures contain a rather lengthy study of Grand Unified Theories as applied both in particle physics and in cosmology. Section I contains some basic points concerning the structure of the standard strong and electroweak interactions prior to grand unification. Sections II and III include the basic principles of GUTS in general. Section IV is devoted to a rather detailed study of the structure and the physics of several leading grand unified models like SU(5), 0(10) and E_6. Finally section V contains the most important cosmological implications of GUTS, including baryon number generation in the early Universe, dissipative processes in the very early Universe, Grand Unified monopoles, a cosmological lower bound on the neutron electric dipole moment, etc.

58297 (INIS-mf—7116, pp vp) **Particle physics and cosmic rays.** Ulrichs, J. (Sydney Univ. (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58298 (INIS-mf—7116, pp vp) **Neutrino oscillations in the early universe.** Granek, H.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58299 (LA-UR—82-1945) **Short-timescale variability in cataclysmic binaries.** Cordova, F.A.; Mason, K.O. (Los Alamos National Lab., NM (USA); University Coll., London (UK). Mullard Space Science Lab.). 1982. Contract W-7405-ENG-36. 16p. (CONF-8206101—1). NTIS, PC A02/MF A01. Order Number DE82019569.

From Conference on pulsations in classical and cataclysmic variable stars; Boulder, CO, USA (1 Jun 1982).

Portions of document are illegible.

Rapid variability, including flickering and pulsations, has been detected in cataclysmic binaries at optical and x-ray frequencies. In the case of the novalike variable TT Arietis, simultaneous observations reveal that the x-ray and optical flickering activity is strongly correlated, while short period pulsations are observed that occur at the same frequencies in both wavelength bands.

58300 (LBL—14513) **Recent results from the Bevalac.** Pugh, H.G. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract AC03-76SF00098. 28p. (CONF-8205102—3). NTIS, PC A03/MF A01. Order Number DE82020128.

From Workshop on quark matter formation and heavy ion collisions; Bielefeld, F.R. Germany (10 May 1982).

In a collision between a 1.8 GeV/amu argon ion and a lead target, the overlapping regions of projectile and target undergo violent interaction while the non-overlapping regions either continue with beam velocity and break up into projectile fragments or remain at rest and break into target fragments. Projectile fragements are the easiest to study; the participants, in the mid-rapidity region, are the next easiest, while the target fragments have not been extensively studied, except by radiochemistry techniques. This talk concentrates (with the exception of a discussion of anomalous projectile fragments) on the participant region, where one would expect to find high densities and temperatures and where evidence of any phase transition might be found. The extensive evidence for a high degree of equilibration at Bevalac energies is omitted, even though the stopping power of nuclei is crucial for possible studies at higher energies.

58301 **(NASA-TM—83849) Magnetic clouds between 2-4 AU: Voyager observations.** Burlaga, L.F.; Behannon, K.W. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Oct 1981. 26p. NTIS, PC A03/MF A01.

Magnetic clouds were observed in the solar wind between 2-4 AU. It was shown that they are stable enough to persist without major changes out to such distances. It is estimated that the clouds expand at a speed of the order of 45 km/s. The average Alfven speed at the front and rear boundaries is 104 km/s, the expansion speed is estimated to be nearly half of the Alfven speed, which is consistent with an earlier estimate of the expansion speed of clouds between the Sun and 1 AU. The magnetic field configuration is highly ordered and consistent with the passage of some kind of loop.

58302 **(NDRE/PUBL—81/1002) Spacecraft and stellar occulations by turbulent planetary atmospheres: a theoretical investigation of various wave propagation effects and their impact on derived profiles of refractivity, temperature, and pressure.** Haugstad, B.S. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). May 1981. 75p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82903432.

The long propagation paths involved in radio and stellar occultations by turbulent planetary atmospheres require that the classical, weak scattering scintillation theory be expanded to account for the inhomogeneous ambient atmosphere upon which the turbulence is superimposed. Such coupling between the turbulent and the ambient components of refractivity reduces the scintillation index by less than a factor of two in shallow radio occultations. For stellar occultations the reduction varies between this value for very small projected stellar radii, to approximately a factor of 3.6 when the projected stellar radius above the planetary limb greatly exceeds the radius of the free-space Fresnel zone at this distance. More profound changes are found in the scintillation power spectrum, the shape of which depends strongly on both occultation depth and geometry when coupling to the inhomogeneous background is properly accounted for. Second-order, systematic propagation effects calculated from both geometrical optics and a wave-optical formulation show that the average phase velocity is increased in the presence of turbulence. The finite (γ^{-}/sup 1/6/) wavelength dependence of the phase path bias implies that an initially non-dispersive medium becomes slightly dispersive by the addition of turbulence. Atmospheric profiles derived from occultations by turbulent planetary atmospheres differ only slightly from those of the corresponding non-turbulent atmosphere when the weak scattering condition is satisfied. Even so, there is strong indication that profiles obtained from radio Doppler measurements are much less affected by turbulence than those from radio or stellar intensity measurements. Systematic errors in refractivity, temperature and pressure are all small for either kind of measurement in the limit of weak scattering. Radio and stellar occultations, when properly conducted and interpreted, are a potential source of information also on turbulence strength, bulk flow scales, planetary rotation and atmospheric winds.

58303 **(PB—82-153040) Solar-geophysical data number 445, September 1981. Part II (comprehensive reports). Data for March 1981, January 1980, and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Sep 1981. 100p. (SGD—445-PT-2). NTIS, PC A05/MF A01.

In addition to an index for 1980-1981, this issue of comprehensive reports provides data for March 1981 on: solar radio emission, solar x-ray radiation and mass ejections from the sun. A new schedule will cause the daily flare index and the regional flare index to appear 13 and 14 months from the date of observation. This issue contains January 1980 solar flares. It also contains the regional flare index for December 1979.

58304 **(PB—82-171083) Solar-geophysical data number 446, October 1981. Part II (comprehensive reports). Data for April 1981, and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Oct 1981. 92p. (SGD—446-Pt-2). NTIS, PC A05/MF A01.

In addition to an index for 1980-1981, this issue of comprehensive reports provides data for April 1981 on: solar radio emission, solar x-ray radiation, and mass ejections from the sun. A new schedule will cause the daily flare index and the regional flare index to appear 13 and 14 months from the date of observation. This issue contains active regions from 9 February - 4 April 1981, synoptic solar maps 9 February - 4 April 1981 and the International Geophysical Calendar for 1982.

58305 **(PB—82-177734) Solar-geophysical data number 447, November 1981. Part II (comprehensive reports). Data for May 1981, February 1980 and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Nov 1981. 84p. (SGD—447-PT-2). NTIS, PC A05/MF A01.

In addition to an index for 1980-81, this issue of comprehensive reports provides data for May 1981 on: solar radio emission, solar x-ray radiation and mass ejections from the sun. Solar flares for February 1980 are given including the daily flare indices. Miscellaneous data includes active regions 4 April - 1 May 1981 and Synoptic solar maps 4 April - 1 May 1981.

58306 **(PB—82-179706) The white light solar corona--an atlas of k-coronameter synoptic charts August 1980 - September 1981. Technical note.** Fisher, R.; Garcia, C.; Rock, K.; Seagraves, P.; Yasukawa, E. (National Center for Atmospheric Research, Boulder, CO (USA)). Jan 1982. 126p. (NCAR/TN—188). NTIS, PC A07/MF A01.

A synoptic observing program was undertaken at the Mauna Loa Solar Observatory, a site operated by the High Altitude Observatory to study the solar corona using the Mark III K-Coronameter. Daily pB images were used to extract three pB ( ) azimuthal scans located at heights of 1.3, 1.7, and 2.1 Rq. Four final data products are given in this atlas: (1) interpolated pB contour plots for h = 1.3 and 1.7 Rq for each Carrington rotation; (2) shaded pB charts for each Carrington rotation; (3) standard zonal pB average values for each day; and (4) autocorrelation estimates of pB variation for equatorial and high latitude structure and an autocorrelation coefficient for an amplitude-independent, first moment of the pB distribution.

58307 **Ultrahigh-energy cross section from study of longitudinal development of air showers.** Ellsworth, R.W.; Gaisser, T.K.; Stanev, T.; Yodh, G.B. (Department of Physics, George Mason University, Fairfax, Virginia 22030). *Physical Review [Section] D: Particles and Fields;* **26**: No. 1, 336-339(1 Jul 1982). Contract AC02-78ER05007.

We present calculations of the type that will be necessary for interpretation of large cosmic-ray experiments that measure longitudinal profiles of individual showers. A primary goal of such experiments is to determine both cross section and composition around 10^{18} eV.

58308 **Two-second variability in AM Herculis binaries.** Middleditch, J. (Los Alamos National Laboratory). *Astrophysical Journal, Letters to the Editor;* **25**: No. 72, L71-L75(15 Jun 1982).

AN UMa and the newly identified AM Her star E1405—451 both show excesses of optical variability in the broad frequency range from 0.4 to 0.8 Hz (2.5—1.25 s). The optical fluxes from AN UMa and E1405—451 must vary by 2.4% and 1.2% rms, respectively, in order to produce the level of noise observed in the power spectra. The noise is not produced during any one section of time or orbital phase but is approximately a constant proportion of the net optical light from E1405—451. The feature is possibly bimodal in AN UMa with a minimum of power at 0.65 Hz. Time series observations of AM Her made during both its "bright" and "faint" phases show that no such noise feature is present to less than 0.25% and 1.3% rms of the stellar light. The predictions of a model for this phenomenon, recently advanced by Langer, Chanmugam, and Shaviv and based on a thermal instability in the height of a standoff accretion shock, are tested with inconclusive results.

58309 **Formation of galaxies in a gravitino-dominated universe.** Bond, J.R.; Szalay, A.S.; Turner, M.S. (Physics Department, Stanford University, Stanford, California 94305). *Physical Review Letters;* **48**: No. 23, 1636-1640(7 Jun 1982). Contract AC02-80ER10773.

If gravitinos of mass 1 keV (or similar particles) dominate the mass of the universe, a critical scale of galactic size arises due to their collisionless phase mixing. It is shown that density perturbation spectrum of gravitinos is relatively flat between galactic and cluster scales, unlike the massive neutrino case. If gravitinos form the dark matter, initial adiabatic fluctuations lead to a hierarchical picture of clustering. Galaxies form first, but dissipation is necessary for their survival.

58310 **Reheating an inflationary universe.** Albrecht, A.; Steinhardt, P.J.; Turner, M.S.; Wilczek, F. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review Letters;* **48**: No. 20, 1437-1440(17 May 1982). Contract AC02-80ER10773.

The evolution of the Higgs expectation value is numerically analyzed and the temperature of the universe during the symmetry-breaking phase transition in an SU(5) theory with radiatively induced symmetry breaking. There is sufficient inflation (exponential expansion) shown to explain the cosmological homogeneity, isotropy, flatness, and monopole puzzles, and also that the universe reheats to a temperature $0(10^{14}$ GeV) so that the usual scheme for baryogenesis can proceed.

58311 **Precise source locations of the anomalous 1979 March 5 Gamma-ray transient.** Cline, T.L.; Desai, U.D.; Teegarden, B.J.; Evans, W.D.; Klebesadel, R.W.; Laros, J.G.; Barat, C.; Hurley, K.; Niel, M.; Vedrenne, G.; Estulin, I.V.; Kurt, V.G.; Mersov, G.A.; Zenchenko, V.M.; Weisskopf, M.C.; Grindlay, J. (Laboratory for High Energy Astrophysics, NASA Goddard Space Flight Center, Greenbelt, Maryland 20771). *Astrophysical Journal, Letters to the Editor;* **255**: No. 1, L45-L48(1 Apr 1982).

Refinements in the source direction analysis of the observations of the unusual 1979 March 5 gamma-ray transient are presented. The final results from the interplantary gamma-ray burst network produce a 0.1 arcmin^2 error box. It is nested inside the initially determined 2 arcmin^2 source region of Evans et al. that identified the supernova remnant N49 in the Large Magellanic Cloud as a possible source. This smaller source location is within both the optical and X-ray contours of N49 although not positioned at either contour center.

58312 **Lepton number violation, Majorana neutrinos, and supernovae.** Kolb, E.W.; Tubbs, D.L.; Dicus, D.A. (Los Alamos National Laboratory, University of California). *Astrophysical Journal, Letters to the Editor;* **255**: No. 1, L57-L61(1 Apr 1982).

Weak interaction theories with Majorana masses for neutrinos have lepton number violating reactions. We consider gravitational collapse of massive stars in such a model and find that if the lepton nonconserving reactions occur, the dynamics of collapse will be drastically different from the low-entropy collapse that follows from the usual assumption of lepton number conservation.

58313 **Maximum extent of flash-driven convection II. The core flash.** Despain, K.H. (Department of Astronomy, Haverford College, Haverford, Pennsylvania; and Theoretical Division, Los Alamos Scientific Laboratory). *Astrophysical Journal;* **253**: No. 2, 811-815(15 Feb 1982).

It is demonstrated that the maximum extent of the flash-driven convective region during the core helium flash is determined by the condition tau/sub d/roughly-equaltau/sub e/, where tau/sub d/ is the radiative diffusion time from the outer edge of the convective region to the outer envelope and tau/sub e/ is the growth time scale for the thermal runaway. This is the same condition that obtains in shell flashes. Numerical experiments with enhanced flashes have been performed in which the convective region approaches but does not penetrate the hydrogen shell though the approach is close enough that overshooting may lead to mixing. The possibility of such enhanced flashes actually occurring is also discussed.

58314 **Mixed lattice phases in cold dense matter.** Jog, C.J.; Smith, R.A. (Department of Physics, State University of New York at Stony Brook). *Astrophysical Journal;* **253**: No. 2, 839-841(15 Feb 1982). Contract AC02-76ER13001.

Over a wide density range, the ground state of cold neutral matter in the absence of external magnetic fields is a degenerate sea of electrons containing a lattice of nuclei. In certain density regions, a phase composed of interpenetrating cubic lattices of different nuclides is preferable to a body-centered cubic lattice of any single nuclide. The arguments supporting this result are first made assuming the electrons to be a uniform background; the qualitative features remain when screening and exchange effects are included.

58315 **Apollo 12 feldspathic basalts 12031, 12038 and 12072 - Petrology, comparison and interpretations.** Beaty, D.W. (California Institute of Technology, Pasadena, Calif.); Hill, S.M.R. (California University, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.). pp 115-139 of Lunar and planetary science conference, 10th, Houston, Tex., March 19-23, 1979, proceedings. Volume 1. New York, NY; Pergamon Press (1979).

From 10. lunar and planetary science conference; Houston, TX, USA (19 Mar 1979).

The paper presents the petrology of Apollo 12 feldspathic basalts. Modal and chemical data indicate that basalts 12072, 12038, and 12031 cannot be related to the other Apollo rock types 12072 contains phenocrysts of olivine and pigeonite, 12038 is a multiply saturated equigranular basalt, and 12031 is a coarse-grained rock with granular to graphic intergrowths of pyroxene and plagioclase. The bulk compositions indicate that these basalts could not have been derived from the Apollo 12 olivine or ilmenite basalts by crystal-liquid fractionation, and their petrologic similarities suggest that they were produced in the same or similar source regions.

58316 **Non-equilibrium effects on the chemistry of nebular condensates: implications for the planets and asteroids.** Blander, M. (Argonne National Laboratory, Argonne, Ill.). pp 809-821 of Asteroids. Gehrels, T. Tucson, AZ; Arizona University (1979).

Kinetic effects, for example nucleation constraints and slow reactions, should have been important in nebular condensation. Consideration of these effects leads to the prediction of pressure-dependent compositions and physical properties of nebular condensates which is consistent with (1) the differences between different classes of chondritic meteorites, (2) some of the differences between planets, and (3) the presence of oxidized iron on the moon and in the eucrite parent body (presumably an asteroid) despite the low abundance of volatiles. Diffusion effects appear to be important for understanding oxygen isotope anomalies in refractory inclusions in Allende. The consideration of kinetic effects leads to more information concerning nebular processes than if equilibrium is assumed.

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REFER ALSO TO CITATION(S) 58056, 58056, 58301

58317 **(AD-A—108800/4) Influence of velocity shear on the Rayleigh-Taylor instability. Memorandum report.** Guzdar, P.N.; Satyanarayana, P.; Huba, J.D.; Ossakow, S.L. (Naval Research Lab., Washington, DC (USA)). 16 Dec 1981. 27p. (NRL-MR—4701). NTIS, PC A03/MF A01.

The influence of a transverse velocity shear on the Rayleigh-Taylor instability is investigated. It is found that a sheared velocity flow can substantially reduce the growth rate of the Rayleigh-Taylor instability in the short wavelength regime (i.e., $kL > 1$ where L is the scale length of the density inhomogeneity), and causes the growth rate to maximize at $kL < 1.0$. Applications of this result to ionospheric phenomena (equatorial spread F (ESF) and ionospheric plasma clouds) are discussed. In particular, the effect of shear could account for, at times, the 100's of km modulation observed on the bottomside of the ESF ionosphere and the km scale size wavelengths observed in barium cloud prompt striation phenomena.

58318 (AD-A—109683/3) Analysis of nuclear propagation effects utilizing wideband satellite data. Final report, 14 January 1980-30 January 1981. Rino, C.L.; Owen, J.; Livingston, R.C. (SRI International, Menlo Park, CA (USA)). 1 Apr 1981. 90p. NTIS, PC A05/MF A01.

Previous analyses of the Wideband Satellite data have emphasized the scale-size regime between 500 m and several tens of kilometers. In this report we describe the results of a detailed analysis of the auroral and equatorial total electron content (TEC) structure associated with the various scintillation phenomena. A nighttime equatorial anomaly was a prominent feature in the equatorial data, particularly as the solar cycle maximum approached. In the auroral data we found that an enhanced F region is the primary contributor to steep latitudinal TEC gradients. Because recent data have shown an abrupt steepening of the irregularity spectral density function near 500 m, a careful analysis of the mutual coherence function was performed to see if this feature could be detected in the Wideband scintillation data. The analysis did indeed reveal such a feature, which is evidently a permanent characteristic of the most severely disturbed equatorial irregularity continuum.

58319 (AD-A—109685/8) Equatorial plasma bubbles: vertically elongated wedges from the bottomside F layer. Technical report. Tsunoda, R.T.; Livingston, R.C. (SRI International, Menlo Park, CA (USA)). 1 Apr 1981. 50p. NTIS, PC A03/MF A01.

We address the question regarding the two-dimensional shape of equatorial plasma bubbles in the plane transverse to the geomagnetic field. By comparing the east-west spatial relationship of ion-density depletions measured insitu by the Atmospheric Explorer-E (AE-E) satellite to backscatter plumes measured by the ALTAIR radar, we show that plasma bubbles are vertically elongated depletions that extend upward from the bottomside of the F layer, in the form of wedges, rather than more isotropically shaped but isolated structures. The shape of plasma bubbles is inferred from (1) ion-density depletions that exceeded 99 percent in the 'neck' regions of plumes, and (2) the eastward drift velocities of the plumes. The expected electrodynamics of vertically elongated plasma bubbles are consistant with the observations of large eastward drift velocities of plumes that are comparable to the F-region plasma drift measurements made at Jicamarca and to F-region neutral wind measurements made at Kwajalein. The results also reveal that the west wall of large-scale altitude modulations of the bottomside F layer that produces the primary plumes and bubbles becomes structured, and evolves with the generation of secondary plumes and bubbles.

58320 (AD-A—109831/8) Time-dependent three-dimensional simulation of the earth's magnetosphere: reconnection events. Memorandum report. Brecht, S.H.; Lyon, J.G.; Fedder, J.A.; Hain, K. (Naval Research Lab., Washington, DC (USA)). 22 Dec 1981. 41p. (NRL-MR—4690). NTIS, PC A03/MF A01.

This paper presents the results of a 3-D simulation of the earth's magnetosphere. The simulation region covered -100 Re < or = x < or = 30 Re, (Y) < or = 40 Re and (Z) < or = Re. The solar wind parameters were Bz = -2 gamma, density of 5 cc and velocity of 400 km/sec. The results show the existence of multiple x-points in the tail. Strong plasma flow is seen to exist in both earthward and tailward directions during formation of neutral lines. The exact magnetic field and plasma behavior is found to be very position dependent.

58321 (AD-A—109894/6) Analysis of project EXCEDE II circular variable filter spectrometer data. Scientific report No. 1, 1 Jul 79-30 Sep 81. Grieder, W.F.; Foley, C.I. (Boston Coll., Chestnut Hill, MA (USA). Mass Space Data Analysis Lab.). 1 Jan 1981. 150p. (BC-SDAL—80-3). NTIS, PC A07/MF A01.

EXCEDE II is the fourth in a series of research experiments conducted by Air Force Geophysics Laboratory (AFGL) to study the infrared emission processes induced by rocketborne electron accelerators. The excitation of the upper atmosphere by the electron beam simulates aurora induced processes but provides the advantage that the dosing is more precisely quantified than in the natural auroral case. In addition, optical/infrared instruments carried onboard the same payload with the accelerator provide controlled viewing geometry of the induced emissions and measurements do not suffer from long path atmospheric attenuation as would be the case for some ground based observations.

58322 (AD-A—110051/0) Barium cloud test in Peru. Interim report Mar-Apr 79. Johnson, A.L.; Swanson, R.L. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA)). Nov 1981. 24p. (AFWAL-TR—81-1178). NTIS, PC A02/MF A01.

In an effort to investigate the mechanism causing ionospheric irregularities to form in the equatorial region an experiment was designed by the Max Planck Institute involving the release of two barium clouds in the F region just after sunset. The electric field resulting from the two barium clouds was expected to trigger an ionospheric irregularity which would propagate up through the ionosphere as a depletion bubble. This report describes an attempt to observe the ionospheric irregularity as it passed through the line-of-sight between an aircraft and a communication satellite. The aircraft was equipped with a UHF receiver which measured phase and amplitude of the downlink Satellite Signal. Due to the release of the barium 50 km below the planned altitude no significant ionospheric irregularities were formed. The aircraft measured minor amplitude variation (1dB) and no significant phase variations resulting from ionospheric irregularities triggered by the barium release.

58323 (AD-A—110228/4) Fission beta particles emitted into the geomagnetosphere. Memorandum report. Bendel, W.L. (Naval Research Lab., Washington, DC (USA)). 23 Dec 1981. 20p. (NRL-MR—4712). NTIS, PC A02/MF A01.

The spectrum of electrons emitted into the earth's magnetic field by an exoatmospheric nuclear burst is considerably more energetic than the spectrum of all delayed electrons from fission, a spectrum often used. A better electron spectrum for general use is presented. Some items are calculated, including a depth-dose curve, and the two spectra are compared.

58324 (AD-A—111266/3) Anomalous resistivity of auroral field lines. Interim report. Rowland, H.L.; Palmadesso, P.J.; Papadopoulos, K. (Naval Research Lab., Washington, DC (USA)). 25 Jan 1982. 9p. (NRL—8537). NTIS, PC A02/MF A01.

Conditions that exist along auroral field lines (del n/sub i// n_0 > 0.24 Omega/sub e//omega/sub > 1/) act to break the adiabatic invariance of the electron magnetic moment, cause strong anomalous dc resistivity, and generate electron distributions in good agreement with observations.

58325 (AD-A—111452/9) Ionospheric irregularity physics modelling. Memorandum report. Ossakow, S.L.; Keskinen, M.J.; Zalesak, S.T. (Naval Research Lab., Washington, DC (USA)). 9 Feb 1982. 53p. (NRL-MR—4741). NTIS, PC A04/MF A01.

Theoretical and numerical simulation techniques have been employed to study ionospheric F region plasma cloud striation phenomena, equatorial spread F phenomena, and high latitude diffuse auroral F region irregularity phenomena. Each of these phenomena can cause scintillation effects. The results and ideas from these studies are state-of-the-art, agree well with experimental observations, and have induced experimentalists to look for theoretically predicted results. One conclusion that can be drawn from these studies is that ionospheric irregularity phenomena can be modelled from a first principles physics point of view. Theoretical and numerical simulation results from the aforementioned ionospheric irregularity areas will be presented.

58326 (AD-A—111456/0) The s3-4 ionospheric irregularities satellite experiment: probe detection of multi-ion component plasmas and associated effects on instability processes. Memorandum report. Szuszczewicz, E.P.; Holmes, J.C.; Singh, M. (Naval Research Lab., Washington, DC (USA)). 11 Feb 1982. 31p. (NRL-MR—4728). NTIS, PC A03/MF A01.

The pulsed plasma probe technique has been expanded to include simultaneous determinations of absolute electron density, density fluctuations, electron temperature, and mean ion mass with resolution limited only by probe geometry, sheath size, and telemetry. The technique has been designed to test for coupling of electron density variations and ion composition irregularities in multi-component plasmas by the comparison of electron density fluctuation power spectra PN(k) and a newly developed diagnostic parameter, the mean ion mass fluctuation spectra Delta M sub i bar/M sub i bar approaches the limit of P sub M(k). In addition, the experiment extends satellite-borne irregularity spectral analyses down to the 5-20 meter range while attempting to synthesize F-region plasma instability processes on the basis of N sub e, T sub e Delta N sub e, P sub N and P sub M. Initial results demonstrate the expanded diagnostic capability for high spatial resolution measurements of mean ion mass and provide experimental evidence for the role of ion composition in multi-stepped plasma instability processes. Limited analyses of the two power spectral elements raises hopes for the differential between plasma mechanisms that can lead to similar indices in PN.

58327 **(AERONOMICA-ACTA-A—221-1980) The internal structure of the magnetopause.** Roth, M. (Institut d'Aeronomie Spatiale de Belgique, Brussels). 1980. 345p. (In several languages). Institut d'Aeronomie Spatiale de Belgique, Brussels.

A kinetic model which describes the internal structure of the magnetopause is developed. Among other factors, the model takes into account the interplanetary magnetic field and the thermal motion of the particles. The structure of a tangential discontinuity in a multicomponent collisionless plasma is described. From consideration of the two-stream instabilities, a minimum magnetopause thickness is deduced. In a hydrogen plasma, this structure corresponds to an ionic layer in which the electric current is only the result of a displacement of ions. The tangential discontinuities observed at the magnetopause are likened to regions where magnetosheath and magnetospheric plasmas are interpenetrated. Quantitative results show that the variations of the different physical factors are analogous to those of satellite observations. More generally, the parameters characterizing this model make it appropriate to describe many types of tangential discontinuities which are likely to appear in other cosmic collisionless plasmas.

58328 **Nonlocal theory of an electrostatic sinusoidal density drift instability.** Thomsen, M.F.; Gary, S.P. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Geophysical Research;* **87**: No. A5, 3551-3560(1 May 1982).

The stability of space plasmas in which the macroscopic variables vary in the direction 1 perpendicular to the magnetic field is usually studied by means of the local approximation, in which the fluctuating potential is assumed to be independent of x. To remove this approximation, we study a nonlocal problem in which the background density, and hence the fluctuating potentials, are periodic in x. From the linear Vlasov/Poisson equations we derive a set of coupled, linear, homogeneous, algebraic equations relating the Fourier amplitudes of the eigensolution. We solve the equations numerically and find a hierarchy of exact eigenmodes characterized by different growth rates and spatial structures. At points where the density gradients is locally zero, the mode amplitude is generally several orders of magnitude lower than the peak amplitude. We study the dependence of these solutions on the parameters which define the background density perturbation and demonstrate a correspondence between these nonlocal results and those obtained with the local approximation. This allows us to illuminate the conditions under which the local theory is a valid approximation and permits us to extend its range of useful application.

58329 **Evidence for quasi-stationary reconnection at the dayside magnetopause.** Gosling, J.T.; Asbridge, J.R.; Bame, S.J.; Feldman, W.C.; Paschmann, G.; Sckopke, N.; Russell, C.T. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Geophysical Research;* **87**: No. A4, 2147-2158(1 Apr 1982).

Several highly unusual encounters with the earth's magnetopause occurred during an ~5-hour period on November 22—23, 1979, when the ISEE 1 and 2 satellites were near orbit apogee (~22.2 R/sub E/) at ~0900 local time. These distant magnetopause crossings corresponded to a subsolar earth-magnetopause distance of ~20.4 R/sub E/ and were associated with a drop in solar wind dynamic pressure to a value (~1.4 x 10^{-10} dynes cm^{-2})~100 times lower than is typical. Accelerated plasma flows whose magnitude and direction were consistent with the predictions of reconnection theory were observed on each of several satellite enecounters with the magnetopause and boundary layer during this 5-hour period. Further, the field variation through the magnetopause layer suggest that the magnetopause had the structure of a rotational discontinuity as required by reconnection theory. These observations thus indicate that on occasion reconnection at the dayside magnetopause can be a quasi-stationary process. Geomagnetic activity during this 5-hour period, and for at least 9 hours thereafter, was extremely low. Thus dayside reconnection is certainly not a sufficient condition for enhanced geomagnetic activity.

58330 **Plasma and magnetic field characteristics of magnetic flux transfer events.** Paschmann, G.; Haerendel, G.; Papmastorakis, I.; Sckopke, N.; Bame, S.J.; Gosling, J.T.; Russell, C.T. (Max-Planck-Institut fuer Physik und Astrophysik, Institut fuer extraterrestrische Physik, 8046 Garching, West Germany). *Journal of Geophysical Research;* **87**: No. A4, 2159-2168(1 Apr 1982).

Plasma and magnetic field data from ISEE 1 and 2 are examined for 5 passes of the magnetopause region at 20°—40° northern latitudes and ~0800 to 1215 hours local time. These intervals contained a total of 15 well-defined magnetic flux transfer events, which occurred in the magnetosheath as well as the magnetosphere. In either case, flux transfer events are characterized by a mixture of magentosheath and magnetospheric particles. This fact strongly supports the hypothesis that flux transfer events represent encounters of reconnected flux tubes. Inside all of the studied events, the magnetic field strength as well as the sum of plasma and magnetic pressures is strongly enhanced. This excess pressure appears to be balanced by the tension of the ambient magnetic field lines as they are draped around the reconnected flux tube. The different observed magnetic field signatures are consistent with expectations for encounters of the flux tubes at different relative locations. Only those events that appear to be crossings of the flux tube close to its magnetopause crossing show large (~100 km s^{-1}) plasma flow speed ehnancements. These increased velocities are restricted to the trailing portion of the events and are directed at large angles with respect to the magnetic field. One hypothesis is that the increased flow speeds are caused by continued reconnection at the low-latitude boundaries of the flux tubes.

58331 **Global Pc 5 event of November 14—15, 1979.** Higbie, P.R.; Baker, D.N.; Zwickl, R.D.; Belian, R.D.; Asbridge, J.R.; Fennell, J.F.; Wilken, B.; Arthur, C.W. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Geophysical Research;* **87**: No. A4, 2337-2346(1 Apr 1982).

Large-amplitude Pc 5 waves with 7—8 min quasi-periodic variations were observed almost continuously for the 48 hours of November 14—15, 1979, by several spacecraft in or near geostationary orbit on the dayside portions of their orbits. The waves were observed as large modulations in both the electron and ion fluxes over a wide range of energies (~1 to 500 keV) by the spacecraft 1976—059, 1977-007, 1979-053, P78-2, and GEOS 2 and as magnetic field peak-to-peak modulations of 15—25 γ by the P78-2 and GOES 2 and 3 magnetometers. The remarkably long persistence of these waves contrasts substantially with observations of typical flux modulation events which usually last less than 1 hour and which typically show little modulation of the > or =150 keV proton fluxes. Data taken concurrently by the ISEE spacecraft in the solar wind and outer magnetosphere indicate that the solar wind also had unusually properties. ISEE 3 measurements indicate that the solar wind velocity (~350 km/s) and density (~2 cm^{-3}) were simultaneously very low for this period. The alpha-to-proton ratio for the solar wind plasma attained an extremely low value (<1%) early in the event. These solar wind properties imply such a much reduced dynamic pressure on the magnetosphere during this period. Consequently, the ISEE 1 and 2 spacecraft passed through the magnetopause at the uncommonly large radial distance of 18 R/

sub E/ at ~0830 local time where the typical magnetopause geocentric distance is 12 R/sub E/. The exceptional solar wind and outer magnetospheric conditions may have determined the unusual properties of the ULF event observed near geostationary orbit. Some candidate mechanisms for producing these oscillations are presented, but no definitive explanation for this event can be given at present.

58332 **Dissipation of ionospheric irregularities by wave-particle and collisional interactions.** Bernhardt, P.A.; Pongratz, M.B.; Gary, S.P.; Thomsen, M.F. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Journal of Geophysical Research;* **87**: No. A4, 2356-2363(1 Apr 1982).

The nonlinear dissipation of plasma irregularities aligned parallel to an ambient magnetic field is studied numerically using a model which employs both wave-particle and collisional diffusion. A wave-particle diffusion coefficient derived from a local theory of the universal drift instability is used. This coefficient is effective in regions of nonzero plasma gradients and produces triangular-shaped irregularities with spectra which vary as f^{-4}, where f is the spatial frequency. Collisional diffusion acts rapidly on the vertices of the irregularities to reduce their amplitude. The simultanteous action of the two dissipative processes is more efficient than collisions acting alone. In this model, wave-particle diffusion mimics the forward cascade process of wave-wave coupling.

58333 **The magnetopause layer and plasma boundary layer of the magnetosphere.** Eastman, T.E. (EG and G, Inc., Los Alamos, N. Mex.); Hones, E.W., Jr. (California, University, Los Alamos, N. Mex.). pp 401-411 of Quantitative modeling of magnetospheric processes. Washington, DC; American Geophysical Union (1979).

Satellite coverage of the sunward magnetopause and plasma boundary layer (PBL) are shown schematically and discussed for four satellites that include both plasma and field measurements. Plasma observations from the VELA satellites first established the continued presence of magnetosheath-like plasma with reduced density and flow velocity in a relatively thin (less than about 1 earth radius) layer bordering the plasma sheet at low latitudes and bordering the lobe environment at high latitudes. Satellite data have demonstrated the presence of PBL over the entire sunward magnetosphere near the magnetopause. A brief summary is presented of recent published results on two distinct regions of the PBL: that bordering open field line regions, and that bordering closed field line regions. Several suggested source mechanisms for the PBL are discussed and compared.

58334 **Solar wind-magnetosphere-ionosphere coupling.** Hones, E.W., Jr. (California, University, Los Alamos, NM). pp 83-100 of Solar-terrestrial influences on weather and climate. Dordrecth, Netherlands; D. Reidel Publishing Co. (1979).

From Solar-terrestrial influences on weather and climate symposium; Columbus, OH, USA (24-28 Aug 1978).

The paper describes the influence of the sun's particulate emissions upon the earth's magnetosphere and its ionosphere. It is concerned only with the solar wind interaction. The discussion covers the following: plasma, momentum, and energy transfer from the solar wind to the magnetosphere the magnetotail: storage and release of energy and interaction of the outer magnetosphere with the ionosphere. Recent evidence suggests that the field-aligned currents from the interaction region create field-aligned fields at altitudes of 1 to 2 earth radii, and that these are responsible for the acceleration of particles that produce auroral arcs.

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REFER ALSO TO CITATION(S) 57706, 57843, 58275, 58469, 58531, 58588, 58739, 58744

58335 **(AD-A—110309/2) Optical pumping studies of collisional interactions. Final scientific report.** Franz, F.A. (Indiana Univ., Bloomington (USA). Dept. of Physics). 23 Nov 1981. 27p. NTIS, PC A03/MF A01.

A final scientific report is given on a project involving application of optical pumping techniques to studies of atomic collisions. Magnetic depolarization, nuclear spin efforts, collisional selection rules, surface interactions, and studies of sudden and quasi molecular collisions between alkali atoms and noble gas atoms are particularly emphasized.

58336 **(AD-A—110689/7) Calculation of electron-hydrogen, deuterium and oxygen molecules. Final report, April 1979-April 1980.** Poe, R.T.; Choi, B.H. (California Univ., Riverside (USA). Dept. of Physics). Jun 1981. 74p. NTIS, PC A04/MF A01.

Calculations are made on the vibrational transition cross sections of e-H2, D2 scatterings in the energy range of 0 appox. 10eV. Both hybrid theory and the simultaneous vibrational and rotational adiabatic-nuclei approximation are employed in the calculation. It turns out that the latter approximation scheme yields better results than the hybrid theory approach when compared with experimental measurements on 0 yields v vibrational excitation. The resonance peaks of the elastic scattering and vibrational excitation cross section obtained from the vibrational and rotational adiabatic-nuclei approximation are quite broad between 2 approx. 3 eV, which are in good agreements with experimental data. This seems to indicate that the periods of the vibrational and rotational motions are comparable to each other and longer than the lifetime of the compound molecule. In general, the rate of the vibrational transition decreases as the quantum number change increases. The e-02 vibrational transition cross sections have also been explored with a semi-quantitative analysis.

58337 **(AD-A—110988/3) Electron excitation and ionization rate coefficients for N_2, O_2, NO, N and O. Memorandum report.** Slinker, S.; Ali, A.W. (Naval Research Lab., Washington, DC (USA)). 25 Feb 1982. 44p. (NRL-MR—4756). NTIS, PC A03/MF A01.

Excitation and ionization rate coefficients for N_2, O_2, NO, N and O are calculated using measured and calculated cross sections. Momentum transfer rate coefficients in N_2, O_2 and O are also calculated.

58338 **(AERE-R—10371) Parameterisation of ion range/energy functions and incorporation in a computer database.** Parker, D.J.; Asher, J.; Barnett, S.J. (UKAEA Atomic Energy Research Establishment, Harwell). Nov 1981. 17p. NTIS (US Sales Only), PC A02/MF A01; Also available from H.M.Stationery Office, price Pound2.00. Order Number DE82702252.

The range curves for various ions in various substrates have been parameterised and the results incorporated into a computer database. The motivation for this work and the approach followed are described, and details given of some associated FORTRAN subprograms for general applications.

58339 **(BNL—31561) Long-range attraction in the collisions of free-molecular and transition-regions aerosol particles.** Marlow, W.H. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 27p. (CONF-820742—1). NTIS, PC A03/MF A01. Order Number DE82019527.

From 13. international symposium on rarefied gas dynamics; Novosibirsk, USSR (5 Jul 1982).

Portions of document are illegible.

An aerosol is the transitional condition of matter between the equilibrium gas and condensed states. This paper reviews recent advances in the description of the compositional dependences of free molecular and transition regime aerosol collision rates that are essential to the understanding of the evolution of this nonequilibrium condition of matter. To set the physical context, selected current advances in homogeneous nucleation theory are described. These results, which are based upon metastable equilibrium prior to the onset of nucleation, are related to the nonequilibrium collisions of post-critical nuclei or aerosols. Since all particles interact via attractive potentials whose mathematical forms become singular at contact, a new procedure is described which has been developed for computing the free molecular collision rates of spherical particles that both exploits this singularity and is readily generalizable to transition regime collisions. The physics of the molecular van der Waals interaction and its mathematical form for interacting point dipoles with arbitrary retardation are reviewed. Difficulties in the straightforward generalization of the molecular theory to condensed media interactions are pointed out and used to motivate the Lifshitz theory of the van der Waals interactions of condensed media. A model for the spectral retardation of the sphere-sphere interaction potential is introduced and used in computations of those energies for 1 to 100 nm radii spheres of several materials. These energies are used in the computation of collision rate enhancements over the hard-sphere collision rates, the properties of these enhancements including the effects of retardation are discussed, and they are compared with experiment where possible. Potential applications of these methods in aerosol flocculation and filtration are discussed.

58340 (CEA-CONF—6000) **Diffraction of high energy electrons.** Bourret, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Oct 1981. 17p. (In French). (CONF-8109141—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702255.

From Summer school of electron microscopy in material sciences; Bombannes, France (21 Sep 1981).

The diffraction of electrons by a crystal is examined to study its structure. As the electron-substance interaction is strong, it must be treated in a dynamic manner. Using the N waves theory and physical optics the base equations giving the wave at the outlet are deduced for a perfect crystal and their equivalence is shown. The more complex case of an imperfect crystal is then envisaged in these two approaches. In both cases, only the diffraction of high energy electrons (> 50 KeV) are considered since in the diffraction of slow electrons back scattering cannot be ignored. Taking into account an increasingly greater number of beams, through fast calculations computer techniques, enables images to be simulated in very varied conditions. The general use of the Fast Fourier Transform has given a clear cut practical advantage to the multi-layer method.

58341 (CONF-810728—6) **Convoy electron production in heavy-ion-solid collisions.** Sellin, I.A.; Breinig, M.; Brandt, W.; Laubert, R. (Oak Ridge National Lab., TN (USA); New York Univ., NY (USA); East Carolina Univ., Greenville, NC (USA)). 1981. Contract W-7405-ENG-26. 29p. NTIS, PC A02/MF A01. Order Number DE82018174.

From 9. international conference on atomic collisions in solids; Lyon, France (6 Jul 1981).

The properties of the sharp v vector/sub e/ ≅ v vector cusps observed in the velocity spectrum of convoy electrons (v vector/sub e/) ejected in heavy ion-solid collisions in the ion velocity range (v vector) 6 to 18 au are compared to the properties of analogous cusps observed in binary electron capture to the continuum (ECC) and electron loss to the continuum (ELC) collisions in gases. Apart from a skew toward v vector/sub e/ > v vector, the v-independent convoy distributions observed are very similar to those for ELC and the cusp widths are the same in both cases. While the shape of convoy peaks is approximately independent of projectile Z, v, and of target material, yields in polycrystalline targets (C, Al, Ag, Au) exhibit a strong dependence on Z and v. Coincidence experiments in which convoy electrons are allocated according to emergent ion charge-state q/sub e/ show a surprising independence of q/sub e/, mirroring the unweighted statistical emergent charge-state fraction. Coincidence experiments of O^{6+} $^{7+}$ $^{8+}$ ions traversing < 110 > and < 100 > channels in Au show a strong yield suppression and a dependence of yield on the channel chosen. Interpretation of these observations, comparisons to convoy production studies using protons, and a discussion of remaining puzzles is given. The history of ECC, ELC, and wake-riding models of convoy electron production is also reviewed.

58342 (DOE/ER/40001—33) **Research and development on optically pumped polarized ion sources. Technical progress report, February 1, 1982-January 31, 1983.** Anderson, L.W. (Wisconsin Univ., Madison (USA)). Jul 1982. Contract AC02-81ER40001. 50p. NTIS, PC A03/MF A01. Order Number DE82019288.

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Progress on the development of optically pumped polarized Li^- and Na^- ion sources is reported. Also, the development of polarized $^3He^-$ and H^- ion sources using optically pumped Na vapor targets is described. (WHK)

58343 (EFI—461(3)-81) **K-ionization by channeling relativistic particles.** Darbinyan, S.M.; Ispiryan, K.A. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702256.

The energy and orientation dependences of the cross-section of atomic K-shell ionization by relativistic particles in crystals are investigated theoretically. It is shoum that the K-shell ionization cross-section in germanium crystal in the case of channelling increases approximately 1.25 and 1.6 times for the axial and planar channelling of negative particles and decreases approximately 0.6 times for planar channelling of positive particles, respectively, as compared with the case of absence of channelling.

58344 (FIAS-R—91) **Electron-hydrogen elastic scattering at intermediate energies.** McCarthy, I.E.; Saha, B.C.; Stelbovics, A.T. (Flinders Univ. of South Australia, Bedford Park. Inst. for Atomic Studies). Feb 1982. 7p. NTIS (US Sales Only), PC A99/MF A01. Order Number DE82701967.

The results of an explicit optical potential calculation of electron-hydrogen entrance-channel data at 50eV, 100eV and 200eV are compared with experiment, with recent optical potential results using different approximations, and with a close-coupling calculation containing pseudostates designed to mimic the effects of higher channels.

58345 (INIS-mf—7059-Vol.1, pp vp) **Muon spin relaxation in random spin systems.** Toshimitsu Yamazaki (Tokyo Univ. (Japan). Faculty of Science). 1981. NTIS (US Sales Only), PC A99/MF A01.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

The longitudinal relaxation function Gsub(z)(t) of the positive muon can reflect dynamical characters of local field in a unique way even when the correlation time is longer than the Larmor period of local field. This method has been applied to studies of spin dynamics in spin glass systems, revealing sharp but continuous temperature dependence of the correlation time. Its principle and applications are reviewed. (author).

58346 (INIS-mf—7116, pp vp) **Nuclear excitation by atomic electron transitions - boundary region between atomic and nuclear physics.** Okamato, K. (New South Wales Univ., Kensington (Australia). Dept. of Applied Mathematics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58347 (INIS-mf—7116, pp vp) **Calculable microscopic cluster methods for composite-particle scattering.** Robson, B.A. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58348 (IPPJ-AM—16) **Two-centre Coulomb phaseshifts and radial functions.** Nakamura, H.; Takagi, H. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Dec 1980. 85p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82701968.

Two-centre radial Coulomb functions and phaseshifts are calculated numerically, and are tabulated. Only the homonuclear case is considered.

58349 (JINR—R-4-81-515) **Convergence of adiabatic expansion in the three-body problem with the Coulomb interaction.** Vinitskij, S.I.; Melezhik, V.S.; Ponomarev, L.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702243.

A method is proposed for calculating the contributions of higher states of the discrete and continuous spectra of the two-center problem into the binding energy of a three-body system, by which the energy levels of mesic molecules may be found with an accuracy of 10^{-3} eV. The convergence of the expansion of wave functions of mesic molecules of hydrogen isotopes over the adiabatic basis is investigated numerically.

58350 (JINR—R-14-81-534) **Temperature breaking of hydrogen bonds in ammonia as studied by πp meson capture in hydrogen.** Bannikov, A.V.; Vasil'ev, V.A.; Kachalkin, A.K.; Levai, B.; Petrukhin, V.I.; Strakovskij, I.I.; Khorvat, D.; Yutlandov, I.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702251.

The capture probability of stopped π^--mesons by hydrogen atoms of ammonia increases with temperature in liquid phase while in supercritical phase it is temperature independent. This effect can be attributed to the temperature breaking of hydrogen bonds. Rough estimations are given for the fraction of broken hydrogen bonds at various temperatures.

58351 (JINR-R—4-81-255) **Nuclear widths and level shifts of a dtμ mesic molecule.** Bogdanova, L.N.; Markushin, V.E.; Melezhik, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702318.

Nuclear widths GITAsup(Jv) and shifts ΔEsup(Jv) of dtμ mesic molecule levels (Jv) due to dt s-wave resonant interaction are expressed through the $d+t \rightarrow n+{}^4He$ reaction cross section. It is established that the nuclear resonance ${}^5He^*(3^+/2)$ weakly influences the spectrum of mesic molecule because of the small probability of dt being inside the range of nuclear forces in the dtμ-molecule and the big inelastic width of the resonance. The nuclear widths and shifts calculated agree well with the results obtained with the generalized optical potential corresponding to the two coupled channels (dt-n^{4}He) problem.

58352 (JUEL—1697) **Measurement of spin polarization of electrons in their photoemission from nickel and cobalt single crystals with photon energies in the area of photothreshold.** Kuhlmann, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Dec 1980. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82903601.

Thesis. Submitted to Koeln University, Germany.

We have measured with s-polarized light near threshold and the spin-polarization P of photoelectrons from Ni(001), -(110) and -(111) and from Co(0001)- and -(10 anti 10) surfaces. The cylindrically shaped samples were magnetized perpendicular to the surface (longitudinal magnetization) up to complete saturation by an external magnetic field. With these experimental conditions a differential energy-analysis as well as angle- analysis of the emitted electrons is not feasible. However, for photon energies in the range 1 to 2 eV above threshold the energy distribution of the collected electrons is narrow and, because of energy conservation, emission occurs primarily normal to the surface (cone$<15^0$). The effect of the external magnetic field on the electron trajectories and their spin direction has been determined by computational methods.

58353 (KFKI—1980-61) **Excitations with complex wavenumbers in a Hubbard chain. I. States with one pair of complex wavenumbers.** Woynarovich, F. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1980. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82902894.

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Those excited states of a half filled 1-d Hubbard chain are studied which are connected with electron pairs occupying the same sites. It is argued, that these states are to be described by such solutions of the Lieb-Wu equations in which some of the wavenumbers are complex. Solutions of this type, corresponding to S/sup z/ = 1/2N-1 and singlet states, are found. The energy-momentum dispersion is also calculated. The gap in the spectrum of the singlet excitations is found to be equal to the discontinuity of the chemical potential calculated by Lieb and Wu.

58354 (KFTI—78-46, pp 47-49) **Emission of relativistic channelling electrons.** Vit'ko, V.I.; Grishaev, I.A.; Shramenko, B.I. 1978. (In Russian). NTIS (US Sales Only), PC A05/MF A01.

In Technique of physical experiment.

The solution of the Dirac equation for electrons in the field of a continuous atomic chain is considered. Wave functions of bound states and energy levels of electrons are found. The expression for the radiation spectrum and total intensity is obtained.

58355 (ORNL—5909) **Enhanced ion backscattering near 180⁰ scattering angles in the two-atom scattering model.** Oen, O.S. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE82020475.

An analytical two-atom scattering model has been developed to treat the recent discovery of the enhancement near 180⁰ of Rutherford backscattering yields from disordered solids. In contrast to conventional calculations of Rutherford backscattering that treat scattering from a single atom only (the backscattering atom), the present model includes the interaction of a second atom lying between the target surface and the backscattering atom. The projectile ion makes a glancing collision with this second atom both before and after it is backscattered. A weighted average is made over all possible positions of this second atom. The model predicts an enhancement effect whose physical origin arises from the tolerance of path for those ions whose ingoing and outgoing trajectories lie in the vicinity of the critical impact parameter. Results using Moliere scattering show how the yield enhancement depends on ion energy, backscattering depth, exit angle, scattering potential, atomic numbers of the projectile and target, and target density. In the model the critical impact parameter and critical angle play important roles. It is shown that these quantities depend on a single dimensionless parameter and formulas accurate to better than 1% are given for them.

58356 **System-bath decomposition of the reaction path Hamiltonian for polyatomic scattering: Quantum perturbative treatment.** Miller, W.H.; Schwartz, S. (Department of Chemistry and Materials and Molecular Research Division of the Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* 77: No. 5, 2378-2382(1 Sep 1982).

An approach to quantum mechanical reactive scattering in polyatomic molecular systems is described. The formulation is based on the reaction path Hamiltonian of Miller, Handy, and Adams [J. Chem. Phys. 72, 99 (1980)]. The essential physical idea is that the reaction coordinate in even polyatomic systems may be coupled strongly to only a few (one or two) of the vibrational modes orthogonal to it, and rather weakly coupled to the (perhaps many) remaining modes. This leads naturally to a "system-bath" decomposition of the reaction process, and this paper shows how this is carried through for the reaction path Hamiltonian. If only one transverse mode is included with the reaction coordinate to form the "system," for example, then the overall model is that of a collinearlike reaction, whose dynamics are treated accurately, taking place in a (harmonic) "bath" to which it is weakly coupled.

58357 **Low temperature free energy relations for electron transfer reactions.** Webman, I.; Kestner, N.R. (Chemistry Department , Louisiana State University, Baton Rouge, Louisiana 70803). *Journal of Chemical Physics;* 77: No. 5, 2387-2398(1 Sep 1982).

Using the multiphonon theory of electron transfer reactions we present calculations and simple expressions for the rate of electron transfer between molecules in a medium as a function of the free energy changes, especially in the exothermic region. We include effects of the medium modes as well as higher frequency modes which are allowed to change during the reaction. We find that there are activated as well as nonactivated regions depending on the free energy change and the temperature. The rate in the so called "anomalous" (or nonactivated) region decreases much more slowly with free energy than it does in the activated region. In fact, the logorithm of the rate depends roughly linearly on the free energy change in that region. Fortunately the rate is most dependent on the frequency of the high energy modes and less on the coupling strength about which we know the least. In addition we have studied uses of frequency averaging to reproduce the results of a multimode case.

58358 Test of the linear sum rule for vibrational energy transfer by trajectory calculations. Truhlar, D.G.; Blais, N.C. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* 77: No. 5, 2430-2431(1 Sep 1982).

Vibrational relaxation rate constants for H_2 in a bath of Ar are computed for v = 0, 4, 6, 10, and 13 and a rotational-translational temperature of 4500 K. The relaxation rate increases by a factor of 5.5 as v is raised from 0 to 10, then decreases by 33% as v is raised to 13. The v dependence of the vibrational relaxation violates a linear sum rule that is required to hold for an information theoretic synthesis of state-specific rate constants from bulk relaxation data.

58359 Study of the formation of high molecular weight water cluster ions (m/e<59 000) in expansion of ionized gas mixtures. Beuhler, R.J.; Friedman, L. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* 77: No. 5, 2549-2557(1 Sep 1982).

Mass spectrometric determinations have been made of size distributions of cluster ions produced by expansion of ionized mixtures of water and various carrier gases. Measurements span a range up to mass to charge ratios of 59 000. Dilute water—nitrogen carrier gas mixtures producing cluster masses up to 12 000 gave size distributions which are first order in water concentration. This observation is explained by the relatively large value of the ion—dipole associative collision cross sections which determined the rate of growth of cluster ions in the mass range studied. Studies in different mass carrier gases show that cluster ion size distributions are largely determined by the cross section for, and number of, associative collisions taking place during the expansion process. Estimates of associative collision efficiency have been made for water and alcohol cluster ion growth on expansion. Evidence has been obtained for steric inhibition of efficient alcohol collision processes compared to relatively efficient water clustering.

58360 Dynamic corrections for neutron scattering of water in the free molecule approximation. Blum, L.; Rovere, M.; Narten, A.H. (Department of Physics, Faculty of Natural Sciences, University of Puerto Rico, Rio Piedras, Puerto Rico 00931). *Journal of Chemical Physics;* 77: No. 5, 2647-2655(1 Sep 1982).

We develop a quantum mechanical theory for the inelasticity or Placzek correction for an asymmetric top rigid rotator, and give a formula to compute this correction for neutron scattering. We have, however, used a sphericalized model which satisfies Mecke's sum rule to compute the correction for H_2O and D_2O. Since this rigid rotor model fails to satisfy the exact first sum rule, we introduce a form that does satisfy this condition. Good agreement with the large momentum exchange (k) behavior in the case of D_2O is obtained. However, for the H_2O this is not so and adjustable parameters have to be introduced to obtain the correction asymptotic behavior.

58361 C(KVV) Auger line shape of chemisorbed CO. Koel, B.E.; White, J.M.; Loubriel, G.M. (Department of Chemistry, University of Texas, Austin, Texas 78712). *Journal of Chemical Physics;* 77: No. 5, 2665-2669(1 Sep 1982).

Using x-ray excitation, the C(KVV) Auger spectrum for CO chemisorbed on Ni(100) has been measured and deconvoluted to provide the undistored line shape. This line shape is compared with spectra for gas phase CO and $Fe(CO)_5(g)$. The magnitude of U/sub eff/, a final state interaction term, is shown to be near zero for chemisorbed CO, indicating that significantly different relaxation/screening processes occur in this case as compared to gas phase CO and metal carbonyls. Charge—transfer screening of the core hole in the Auger initial state is proposed to account for the small value of U/sub eff/.

58362 Observation of a steric effect in the reaction of Xe* with photodissociation polarized IBr. de Vries, M.S.; Srdanov, V.I.; Hanrahan, C.P.; Martin, R.M. (Department of Chemistry, University of California, Santa Barbara, California 93106). *Journal of Chemical Physics;* 77: No. 5, 2688-2689(1 Sep 1982).

This communication reports the first use of photodissociation polarization to study reaction cross sections as a function of molecular orientation. A beam of metastable Xe* atoms was crossed with a beam of rotationally oriented IBr molecules. Excimer formation was studied as a function of IBr orientation, by observation of the excimer emission intensity. The reaction cross section was found to be largest when the Xe* approaches parallel to the plane of rotation of the IBr, and smallest when the Xe* approaches perpendicular to the plane of rotation.

58363 Vibrational anharmonicity constants for UF_6: The ν_3 transitions at 16 μm. Krohn, B.J.; Kim, K.C. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* 77: No. 4, 1645-1648(15 Aug 1982).

Assignment of nine hot-band Q branches in the ν_3 (16 μm) region of the diode laser spectrum of UF_6, and measurement of their wave number displacements from the origin of the fundamental band, provide values of effective anharmonicity constants x_{34}, x_{35}, and x_{36}. The relationship x/sub 3j/ = -aω°/sub j/, where a = (1.28 +- 0.08) x 10^{-3} and ω°/sub j/ = normal-mode wave number for j = 4, 5, or 6, has been used to compute spectra in good qualitative agreement with observed spectra between T = 170 K and room temperature.

58364 Time-independent quantum mechanical theory for multiphoton dissociation of diatomic molecules. Whaley, K.B.; Light, J.C. (The James Franck Institute and The Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). *Journal of Chemical Physics;* 77: No. 4, 1818-1825(15 Aug 1982).

A nonperturbative expression for the rate of dissociation from the ground vibrational state of a diatomic molecule in the presence of an infrared laser field is derived using R-matrix techniques. No rotating wave approximation and no metastable levels are introduced. The result is applied to a model system and to HF to obtain the dependence of multiphoton dissociation rate upon laser frequency and intensity. Dissociation is predicted at fields of order 10^{13} W/cm².

58365 Multiphoton photofragmentation of SO_2 at 248 nm. Wilson, M.W.; Rothschild, M.; Muller, D.F.; Rhodes, C.K. (Department of Physics, University of Illinois at Chicago Circle, Chicago, Illinois 60680). *Journal of Chemical Physics;* 77: No. 4, 1837-1841(15 Aug 1982).

Sequential two-photon photoexcitation of SO_2 at 248 nm is found to lead to a number of primary fragments including $S(^3P)$ and $SO(X\ ^3\Sigma^-)$. Further excitation of some of these photoproducts was also observed, occurring by both linear and two-quantum mechanisms. The resulting molecular X←B (v",2) ultraviolet fluorescence from SO and the atomic $^3P \leftarrow {}^3S$ vacuum ultraviolet emission from S atoms were detected and an analysis of the energy flow patterns was made.

58366 Effects of collision energy and ion vibrational excitation on proton and charge transfer in H_2i $+N_2$, CO, O_2. Anderson, S.L.; Turner, T.; Mahan, B.H.; Lee, Y.T. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* 77: No. 4, 1842-1854(15 Aug 1982).

The effects of vibrational excitation of reagent ions and collision energy on the proton and charge transfer reactions of H_2^+ and D_2^+ with N_2, CO, and O_2 have been investigated using a method combining photoionization and a radio frequency guided ion technique. For proton transfer the $H_2^+ + N_2$ results are quite similar to the $H_2^+ + Ar$ system; proton and charge transfer channels are closely coupled for kinetic energies above 3 eV. In contrast, for $H_2^+ + CO$, the vibrational dependence of proton transfer is quite weak. For the $H_2^+ + O_2$ case, evidence is seen for direct competition between the charge and proton transfer process. A simple model for charge transfer is used to assess the importance of energy resonance and Franck—Condon effects. In these simple molecular systems, the energy defect is found to be most important to charge exchange, although Franck—Condon factors play a substantial role.

58367 Rare gas—halogen atom interaction potentials from crossed molecular beams experiments: I(^{2}P/sub 3/2/)+Kr, Xe($^1S_0$). Casavecchia, P.; He, G.; Sparks, R.K.; Lee, Y.T. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* 77: No. 4, 1878-1885(15 Aug 1982).

Angular distributions of I(^{2}P/sub 3/2/) scattered off Kr and Xe($^1S_0$) in the thermal energy range have been measured in crossed molecular beams experiments. The interaction potentials for two relevant states (X 1/2 and I 3/2) for each of the systems are obtained by using an approximate elastic scattering analysis, which neglects nonadiabatic coupling, as previously done for other rare gas—halogen systems. The I—Xe (X 1/2) potential (epsilon-c = 0.69 kcal/mol, r/sub m/ = 4.30 A) and, to some extent, I—Kr (X 1/2) potential (epsilon-c = 0.55 kcal/mol, r/sub m/ = 4.05 A) shows a slightly more attractive interaction than the interaction potentials of Xe—Xe and Xe—Kr, but the I—Xe (I 3/2) potential (epsilon-c = 0.48 kcal/mol, r/sub m/ = 4.60 A) and the I—Kr (I 3/2) potential (epsilon-c = 0.36 kcal/mol, r/sub m/ = 4.32 A) present shallower epsilon-c's, a larger r/sub m/, and stronger repulsive walls than the corresponding rare gas pair potentials. The results obtained from this and previous investigations are reviewed.

58368 Measurement of atomic densities using radiation trapping. Garver, W.P.; Pierce, M.R.; Leventhal, J.J. (Department of Physics, University of Missouri-St. Louis, St. Louis, Missouri 63121). *Journal of Chemical Physics;* 77: No. 3, 1201-1205(1 Aug 1982).

The apparent lifetimes of the ^{2}P/sub 1/2/ and ^{2}P/sub 3/2/ states of Na have been measured as functions of n, the atomic density, and the results compared to theory. It is shown that these measurements made under equilibrium, steady-state conditions may be used to determine n under nonequilibrium, nonsteady-state conditions. This technique of measuring n has advantages over the surface ionization technique, especially for values of n greater than about 10^{10} cm^{-3}. Extension of the technique to other atoms and molecules is discussed.

58369 Trimer formation, atom exchange, and dissociation in argon dimer collisions. Thompson, D.L. (Department of Chemistry, Oklahoma State University, Stillwater, Oklahoma 74078). *Journal of Chemical Physics;* 77: No. 3, 1269-1273(1 Aug 1982).

Cross sections and rate coefficients are presented for the reactions that occur in argon dimer—dimer collisions. Quasiclassical trajectories are used to compute cross sections as a function of the initial relative translational energy and rate coefficients as a function of translational temperature and initial argon dimer internal excitation for trimer formation and the dissociation reactions.

58370 Influence of vibrational and translational energies on energy transfer in Ar+HCl (J = 0, 2, 6, and 12). Thompson, D.L. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* 77: No. 3, 1286-1294(1 Aug 1982).

The influence of initial relative translational energy on pure-rotational energy transfer in various vibrational states of HCl in collisions with Ar has been studied by using quasiclassical trajectory calculations and a model potential-energy surface. The vibrational states v = 0, 3, and 6 and initial rotational states J/sub i/ = 0, 2, 6, and 12 were studied over the collision energy range 0.1 to 1.0 eV. The results show that pure-rotational energy transfer is not, in general, a strong function of the vibrational state in which the energy transfer takes place. It is found that there is a difference in the dependence of the cross section on the initial relative translational energy for low J/sub i/ and high J/sub i/.

58371 Classical and quantum mechanical studies of HF in an intense laser field. Dardi, P.S.; Gray, S.K. (Department of Chemistry and Materials and Molecular Research Division of the Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* 77: No. 3, 1345-1353(1 Aug 1982).

The behavior of an HF molecule in an intense laser field is investigated with both classical trajectories and quantum dynamics. Vibration-rotation transition probabilities and energy absorption as a function of laser pulse time are calculated for the diatomic initially in its ground state. For comparison, results are also reported for a model nonrotating HF molecule. It is found that classical mechanics does not predict the correct time behavior of the system, nor does it predict the correct rotational state distributions. Classical mechanics does, however, predict pulse time averaged quantities to be the correct order of magnitude. There is also a correct general trend of increased multiphoton excitation for laser frequencies red-shifted from the one-photon resonance, although multiphoton resonance peaks are not observed in the classical results and far too little multiphoton excitation is predicted. The effect of laser phase has also been investigated and shown to be relatively unimportant in both the classical and quantum dynamics.

58372 Electronic energy transfer in near-resonant electron capture collisions of H^+Z with metal atoms: Radiative and nonradiative transitions. Gellene, G.I.; Cleary, D.A.; Porter, R.F.; Burkhardt, C.E.; Leventhal, J.J. (Department of Chemistry, Cornell University, Ithaca, New York 14853). *Journal of Chemical Physics;* 77: No. 3, 1354-1361(1 Aug 1982).

Modes of energy disposal in electron capture of $H^+{}_2$ with metal atoms (Cs, K, Mg, and Zn) for ion velocities in the range 3—7 x 10^7 cm/s are examined using combined optical and beam scattering techniques. Radiative and nonradiative transitions are observed for processes occurring under near resonant conditions. The following branching sequences are identified: Branching ratios are dependent on the vibrational state and the nuclear separation (Franck—Condon factors) of the $H^+{}_2$ ion at the time of electron capture. The branching ratio decreases for the (triplet)/(singlet) formation for H_2 produced from reactions of vibrationally relaxed $H^+{}_2$ ion with K or Cs. Under conditions of $H^+{}_2$ ion relaxation, the kinetic energy of scattered atomic hydrogen following radiative decay from $^3\Sigma^+$/sub g/ state of H_2 increases, implying a shift in the $^3\Sigma^+$/sub g/→$^3\Sigma^+$/sub u/ continuum toward longer wavelengths. The results also show that, at these velocities, the reations occur under near-resonant conditions with vertical transitions.

58373 Mechanisms for electronic energy transfer between molecules and metal surfaces: A comparison of silver and nickel. Whitmore, P.M.; Robota, H.J.; Harris, C.B. (Department of Chemistry and Materials and Molecular Research, Division of Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* 77: No. 3, 1560-1568(1 Aug 1982).

The phosphorescence lifetime of pyrazine above a Ag (111) surface has been measured as a function of molecule—metal separation between 10 and 420 A. The distance dependence of lifetime is in accord with the predictions of the classical point dipole theory over this range of distances. Using this classical model, the decay of electronically excited pyrazine is separated into contributions from radiative decay, resonant surface plasmon excitation, and lossy surface wave damping. The relative importance of these decay channels is calculated for silver and nickel in the near UV, and the dominant mechanism for energy transfer to these two metals in this distance regime is interpreted in terms of the electronic structure of the metal.

58374 Fabrication of extractor grids for neutral beam sources. Brouchous, D.A.; Conrad, J.R. (Department of Nuclear Engineering, University of Wisconsin, Madison, Wisconsin 53706). *Review of Scientific Instruments;* **53**: No. 8, 1182-1184(Aug 1982).

The fabrication of tungsten wires for use in extractor grids on neutral beam ion sources is described. The tungsten wires are machined from 0.152-cm-diam tungsten wires into triangular wires by a three-step grinding process. These grid wires have been used in the neutral beam sources for Phaedrus (6 keV beams) and for the Wisconsin Levitated Octupole (15 keV beams). The beam angular divergence is comparable to that obtained from commercially supplied grid wires.

58375 Simple sample cell for deoxygenation of surfactant solutions. Buell, S.L.; Demas, J.N. (Department of Chemistry, University of Virginia, Charlottesville, Virginia 22901). *Review of Scientific Instruments;* **53**: No. 8, 1298-1299(Aug 1982).

A simple gas bubbling system for removal of dissolved oxygen in micellar and surfactant solutions is described. The cell design allows for a continuous rapid flow of a purge gas through a surfactant solution without loss of fluid in spite of severe foaming. A long-necked cell with a conical top causes the bubbles to rupture without overflowing, and the fluid returns to the bulk solution. The cell offers numerous advantages over freeze pump thaw and other methods of deoxygenation in terms of speed, ease of sample preparation, and cost.

58376 Generation of a cold, intense relativistic electron beam using a magnetized foilless diode. Sheffield, R.L.; Montgomery, M.D.; Parker, J.V.; Riepe, K.B.; Singer, S. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **53**: No. 8, 5408-5413(Aug 1982). Contract W-7405-ENG-36.

An annular electron beam with less than 30 mrad of angular velocity spread, a radius of 1 cm, and a current density exceeding 0.4 MA/cm^2 has been generated with a magnetized foilless diode. The diode current loss is limited to less than a few percent by careful design of the tapered transition region connecting a self-magnetically insulated vacuum transmission line to the externally magnetized foilless diode. Details of the transition section design and operating characteristics of the electron beam generator are given.

58377 Operating characteristics of a magnetically insulated reflex ion diode. Strobel, G.L. (Lawrence Livermore National Laboratory, University of California, P. O. Box 808, Livermore, California 94550). *Journal of Applied Physics;* **53**: No. 8, 5414-5419(Aug 1982).

Steady-state space charge limited-flow calculations have been carried out for an applied B/sub theta/ magnetically insulated reflexing ion diode. Reflex ion energy spectra characteristic of a thin foil cathode and of a transparent mesh have been used. A one-dimensional calculation shows higher ion current densities with a mesh cathode, and that the emission electron current density increases with the applied B/sub theta/ magnetic field. The ion current density is calculated to increase slightly with radius.

58378 Absolute experimental cross sections for the electron impact single, double, triple, and quadruple ionization of Cs^+ ions. Hertling, D.R.; Feeney, R.K.; Hughes, D.W.; Sayle II, W.E. (School of Electrical Engineering, Georgia Institute of Technology, Atlanta, Georgia 30332). *Journal of Applied Physics;* **53**: No. 8, 5427-5434(Aug 1982).

Absolute cross sections for the single, double, triple, and quadruple ionization of Cs^+ ions by electron impact have been measured from below their respective thresholds to approximately 5000 eV. These measurements have been made using a crossed beam facility operated in a pulsed beam mode. Numerous consistency checks were performed in order to identify and evaluate possible sources of experimental error.

58379 Vibrational and rotational energy distribution of NO scattered from the Pt(111) surface: Detection by two-photon ionization. Asscher, M.; Guthrie, W.L.; Lin, T.; Somorjai, G.A. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Department of Chemistry, University of California, Berkeley, California 94720). *Physical Review Letters;* **49**: No. 1, 76-79(5 Jul 1982). Contract AC03-76SF00098.

The vibration and rotational state distributions of a supersonic nitric oxide beam, scattered from a Pt(111) single crystal surface, were investigated. A two-photon ionization technique was applied to monitor the internal energy content of the scattered molecules. Vibrational distributions were found to be colder than that corresponding to the crystal temperature between 450—1100 K. Rotational temperatures were also found to be colder than expected for thermal equilibrium with the platinum surface.

58380 Generation of continuously tunable narrow-band radiation from 1220 to 1174 A in Hg vapor. Tomkins, F.S.; Mahon, R. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Optics Letters;* **7**: No. 7, 304-306(Jul 1982).

Continuously tunable, narrow-band radiation is generated in Hg vapor from the 11p $^1P_1$ transition at 1220 A, through the series limit at 1187.9 A, and on out to 1174 A. This range includes the resonance transitions of neutral atomic hydrogen, deuterium, nitrogen, and xenon, some absorption profiles of which are presented.

58381 Atomic emission spectroscopy with a skimmed inductively coupled Ar plasma. Montaser, A.; Fassel, V.A. (Ames Laboratory and Department of Chemistry, Iowa State University Ames, Iowa 50011). *Applied Spectroscopy;* **36**: No. 4, 454-459(Jul 1982). Contract W-7405-ENG-82.

A skimmer located below the usual observation height of an inductivity coupled plasma (ICP) allows the axial channel region of the ICP to flow through the central hole of the skimmer while the outer Ar flow is deflected. Signal-to-background (S/B) ratio and the estimated detection limits measured immediately above the skimmer were generally 5 to 20 times superior to the best results obtained by the conventional ICP system. The highest S/B lines possessed wavelengths greater than 300 nm. Matrix effect studies on the $Ca\text{-}PO_4$ and the Ca-Al systems revealed that the skimmed plasma was as free of vaporization-atomization interference as the conventional plasma, but easily ionizable elements produced a greater level of suppression/enhancement effects. Electron number densities, as determined via the series limit line merging technique, were lower in the skimmer plasmas as compared with the conventional ICP's.

58382 Corrections to the muonium hyperfine splitting of relative order α2(m/sub e//m/sub μ/). Bodwin, G.T.; Yennie, D.R.; Gregorio, M.A. (Department of Physics, University of Illinois at Champaign-Urbana, Urbana, Illinois 61801). *Physical Review Letters;* **48**: No. 26, 1799-1802(28 Jun 1982).

This paper presents the results of an analytic calculation of the corrections of relative order α^2(m/sub e//m/sub μ/) to the muonium ground-state hyperfine splitting due to exchanged photons. Theory and experiment are compared, with these corrections and some radiative-recoil contributions described in an accompanying paper taken into account.

58383 Kinematic analysis of photoelectrons from polarized targets with J = 1/2. Huang, K. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **48**: No. 26, 1811-1814(28 Jun 1982). Contract W-31-109-ENG-38.

A complete kinematic analysis of photoelectrons from polarized targets with total angular momentum J = 1/2 is given for the first time. Several simple experiments are suggested to test correlation and relativistic effects in atoms or molecules.

58384 Variational Monte Carlo Calculations for spin-aligned deuterium. Panoff, R.M.; Clark, J.W.; Lee, M.A.; Schmidt, K.E.; Kalos, M.H.; Chester, G.V. (McDonnell Center for the Space Sciences and Department of Physics, Washington University, St. Louis, Missouri 63130). *Physical Review Letters;* **48**: No. 24, 1675-1677(14 Jun 1982). Contract AC02-79ER10353;AC02-76ER03077.

The first variational Monte Carlo calculations of the ground-state energy of spin-aligned deuterium Darrow-down are presented. By using the Slater-Jastrow trial wave functions, the calculations are based on the accurate theoretical pair potential of Kolos and Wolniewicz for the $b^3\Sigma^+$/sub u/ state. For Darrow-down with equal population of the three nuclear-spin states, the minimum theoretical ground-state energy is found to be negative, implying that this system is a liquid at zero temperature under zero external pressure.

58385 Time-dependent Hartree-Fock theory of charge exchange: Application to He^{2+}/He. Kulander, K.C.; Devi, K.R.S.; Koonin, S.E. (Theoretical Atomic and Molecular Physics Group, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *A: General Physics;* **25**: No. 6, 2968-2975(Jun 1982).

An application of the time-dependent Hartree-Fock (TDHF) theory of charge transfer in atomic collisions is presented. Probabilities for elastic and double symmetric charge exchange are calculated for a fixed laboratory scattering angle and for collision energies from 10 to 70 keV. The TDHF equations are solved using finite difference techniques and propagated in time using the Peaceman-Rachford alternating-direction implicit method. Plots of time-evolved charge densities are presented also.

58386 Observation of two-electron photoionization of the H^- ion near threshold. Donahue, J.B.; Gram, P.A.M.; Hynes, M.V.; Hamm, R.W.; Frost, C.A.; Bryant, H.C.; Butterfield, K.B.; Clark, D.A.; Smith, W.W. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **48**: No. 22, 1538-1541(31 May 1982). Contract AS04-77ER03998.

Photoejection of both electrons from the H^- ion by a single incident photon has been observed with use of a crossed relativistic beam technique. The dipole selection rules for a single-photon pick out the $^1P^0$ final state. The relative cross section was measured over a 0.30 eV range of photon energies near threshold in steps of 0.007 eV with a resolution of 0.007 eV full width at half maximum. The energy dependence of the cross section in this region was consistent with a Wannier threshold law.

58387 Application of ab-initio optical potentials to low-energy electron-H_2 scattering. Schneider, B.I.; Collins, L.A. (Los Alamos National Lab., NM (USA)). *Journal of Physics B: Atomic and Molecular Physics;* **15**: No. 9, L335-L340(14 May 1982).

The linear algebraic technique is extended from the static-exchange level to treat correlation and polarisation effects in electron-molecule collisions by means of an optical potential. The technique is applied to e-H_2 scattering.

58388 Close-coupling calculation of Li^+-H_2 diffusion cross sections. Dickinson, A.S.; Lee, M.S. (Newcastle upon Tyne Univ. (UK). Dept. of Atomic Physics); Lester, W.A. Jr. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Journal of Physics B: Atomic and Molecular Physics;* **15**: No. 9, 1371-1376(14 May 1982).

The diffusion cross sections Qsub(d)(j→j^1) have been calculated for the 0→0, 0→2 and 2→2 transitions in Li^+-H_2 collisions at total energies between 46.4 and 51 meV. For the elastic cross sections the results were within 15% of those obtained classically using the spherical component of the H_2 polarisability. The value of Qsub(d)(0→2) is much larger than that obtained previously by Alexander (J. Chem. Phys.; 64:4498 (1976)) but is too small to be significant for the room-temperature mobility.

58389 Electron energy recovery system for negative ion sources. Dagenhart, W.K.; Stirling, W.L. (to Department Of Energy). US Patent 4,329,586. 11 May 1982. Filed date 17 Sep 1980. vp.

PAT-APPL-187915.

An electron energy recovery system for negative ion sources is provided. The system, employs crossed electric and magnetic fields to separate the electrons from ions as they are extracted from a negative ion source plasma generator and before the ions are accelerated to their full kinetic energy. With the electric and magnetic fields oriented 90° to each other, the electrons are separated from the plasma and remain at approximately the electrical potential of the generator in which they were generated. The electrons migrate from the ion beam path in a precessing motion out of the ion accelerating field region into an electron recovery region provided by a specially designed electron collector electrode. The electron collector electrode is uniformly spaced from a surface of the ion generator which is transverse to the direction of migration of the electrons and the two surfaces are contoured in a matching relationship which departs from a planar configuration to provide an electric field component in the recovery region which is parallel to the magnetic field thereby forcing the electrons to be directed into and collected by the electron collector electrode. The collector electrode is maintained at a potential slightly positive with respect to the ion generator so that the electrons are collected at a small fraction of the full accelerating supply voltage energy.

58390 Photoelectron angular distributions: energy dependence for s subshells. Manson, S.T.; Starace, A.F. (Department of Physics, Georgia State University, Atlanta, Georgia 30303). *Reviews of Modern Physics;* **54**: No. 2, 389-405(Apr 1982). Contract AC02-76ER02892.

An overview of the theory of photoelectron angular distributions for atoms is presented. Its features, which are embodied in a single asymmetry parameter β in the electric dipole approximation, are examined within the framework of the angular momentum transfer formulation. The β parameter is in principle always energy dependent. Within the LS coupling approximation, however, there are instances, each representing a multitude of particular photoionization processes, in which β is an analytically determined constant. The energy dependence of the β parameters in such instances is due entirely to spin-orbit and other relativistic interactions. It is shown that the asymmetry parameters for atomic s subshells are particularly suitable for distinguishing between purely geometrical effects on the photoelectron angular distribution, resulting from physical conservation laws, and dynamical effects arising from relativistic interactions and electron exchange and correlation. In general, the β parameters for s subshells vary with energy; such variation is largest near minima in the cross sections for the corresponding photoelectron channels and in the vicinity of resonances. However, a number of atomic photoionization transitions are identified for which β would be a constant (equal to one of the three values 2, 1/5, or -1) were it not for relativistic interactions and (in some cases) final-state interchannel coupling and/or initial-state electron correlations. Measurement or calculation of the β parameters for such transitions thus provides a sensitive measure of the strength of relativistic interactions as well as of electron correlations.

58391 Reversibility effects in disordered and ordered solids leading to scattered-ion yield enhancements near 180°. Appleton, B.R.; Holland, O.W.; Barrett, J.H. (Oak Ridge National Lab., TN (USA). Solid State Div.). *Nuclear Instruments and Methods in Physics Research;* **191**: No. 1-3, 507-515(31 Dec 1981).

From 5. international conference on ion beam analysis; Sydney, Australia (16 - 20 Feb 1981).

A general review is given of the recently discovered phenomenon of enhanced ion backscattering near 180°. Examples of experimental results are presented that illustrate the nature of the enhancement and its basic dependences on angle and depth. It is shown that the various aspects of the effect can be reproduced by computer simulations that include the effects of trajectory reversibility, nuclear recoils and detector depth resolution. Measured and calculated results are given that illustrate the dependences of the enhancement on ion and target parameters. Results are presented of the enhancement observed in amorphous Ge and in single crystal of Ge rotated to create a reference spectrum. The enhancement is greater for the rotating crystal case demonstrating crystalline effects on the enhancement. Also presented are some results for the enhancement of the surface yield in a channeling direction of a crystal in the 180° geometry; possible application for surface studies is discussed.

58392 **Vibrational and rotational energy transfer in Ar + HF.** Thompson, D.L. (Los Alamos National Lab., NM). *Chemical Physics Letters;* **84**: No. 2, 397-400(1 Dec 1981).

State-to-state energy transfer cross sections for Ar + HF (v = 2, 4, and 6; J = 4, 6, 8, and 10) were computed using quasiclassical trajectories. Rotational energy transfer is invariant with increasing v, but vibrational energy transfer is significantly enhanced by increasing J.

58393 **Asymptotic, Pade approximant method for legendre series.** Baker, G.A. Jr.; Gubernatis, J.E. pp 232-242 of Orthogonal polynomials, continued fractions and Pade approximation. Los Alamos, NM; Los Alamos Scientific Laboratory (1980).

We introduce a generalized, Pade approximant. The distinctive feature of the method is its incorporation of a known asymptotic behavior of the series coefficients as a function of their order. For several examples drawn from potential scattering theory, this method of acceleration of convergence is compared with two others and is found to be the most efficient, but not dramatically so.

58394 **Nonlinear optical processes in atoms and molecules using rare-gas halide lasers.** Bischel, W.K. (SRI International, Menlo Park, CA); Bokor, J.; Kligler, D.J.; Rhodes, C.K. *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-15**: No. 5, 380-392(May 1979). Contract AM03-76SF00115.

The use of nonlinear optical processes expands the flexibility of excimer systems in the study of a wide range of atomic and molecular phenomena and materials. These mechanisms have already allowed for the selective excitation of states in the 10 to 20 eV range involving bound state excitation, ionization, and molecular dissociation. Specific examples involving the electronic excitation of H_2, Kr, and Xe, the production of Xe^+ for the analysis of the molecular properties of XeF^*, and nonlinear photodissociation of N_2O and OCS are discussed. 61 references, 11 figures.

58395 **Properties of continuum source particle beams. I. Calculation methods and results.** Dahneke, B.E.; Cheng, Y.S. (Univ. of Rochester, NY). *Journal of Aerosol Science;* **10**: 257-274(1979).

The properties of continuum source particle beams, also called aerosol beams or seeded molecular beams, are investigated. Beams generated by expansions through converging cone nozzles are considered. Beam properties pertinent to the application of aerosol beams in the on-line measurement of particle size and composition distributions are emphasized. Methods for calculating the dependence of aerosol beam properties on particle size, shape and mass, source temperature and pressure and nozzle geometry are described and results are presented. The calculated results are compared to experimental data. A simple empirical method of modeling frictionless, isentropic transonic and supersonic flow in a free jet is described and used in the numerical experiments.

58396 **Behavior of decaying states in applied fields.** Low, F.E. (Massachusetts Inst. of Tech., Cambridge). *Physica A (Amsterdam);* **96**: 260-262(1979).

The behavior of decaying atomic states in applied fields is studied. Corrections to expected line shapes of order α^3Z^2 are found and calculated for the hydrogen n = 2 system.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 58395

58397 **(AD-A—110929/7) MHD phenomena at high magnetic Reynolds number. Final report.** Gill, S.P.; Mukherjee, D. (Artec Associates, Inc., Hayward, CA (USA)). Dec 1981. 104p. (FR—137). NTIS, PC A06/MF A01.

Exact MHD solutions have been derived for the propagation of a shock-ionized plasma through applied magnetic field configurations pertinent to two- and three-dimensional MHD generators and plasma diagnostics. Calculated magnetic field perturbations and Faraday voltages are presented for a wide range of magnetic Reynolds number. The solutions provide insight into eddy current and magnetic diffusion effects in MHD generator sections.

58398 **(AD-A—111012/1) Finite element analysis of magnetoelastic plate problems. Technical report February 1979-August 1981.** Yuan, K.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Structural Engineering). Aug 1981. 247p. NTIS, PC A11/MF A01.

Magnetic forces acting on conducting metal structures are significant in the design of such devices as fusion reactors, magnetohydrodynamic generators, magnetically levitated vehicles, magnetic forming devices, and various electric machines. The magnetic loads on these structures may be pulsed or cyclical and arise from the interaction between the induced eddy currents in the conductor and the externally applied magnetic fields. Moreover, the velocity and finite deformation of the conducting structure may interact with the electromagnetic fields to yield a coupled problem. This thesis presents an integrated study of magnetoelasticity problems for thin nonferrous conducting plates. Three phases of the study have been emphasized: theoretical modelling of interaction problems, finite element eddy current calculations for rigid conducting plates, and finite element numerical studies of coupled magnetoelastic problems. Experimental results by others and analytical solutions for limiting cases have been used to verify the numerical results obtained at each stage of the investigation. The Fortran programs developed for each part of the study are also described. The electrodynamics and continuum mechanics bases of the problem are presented in the modelling part of the study.

58399 **(CEA-CONF—5888) Volume misfit around an isotopic impurity in solid helium.** Landesman, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). Aug 1981. 3p. (CONF-810809—27). NTIS (US Sales Only), PC A02/MF A01.

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 Aug 1981).

The dilation associated to substitutional impurities in solid helium is related to their influence on the thermal conductivity and to their motion as studied by NMR. The agreement between the results of various experiments and theoretical models is shown to remain unperfect.

58400 **(CEA-CONF—5986) Numerical simulation of the non-linear turbulent dynamo effect.** Meneguzzi, M.; Frisch, U.; Leorat, J.; Pouquet, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Electronique Physique). Sep 1981. 2p. (In French). (CONF-8109140—1(Summ.)). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702253.

From 5. French symposium on mechanics; Marseille, France (7 Sep 1981).

58401 **(DOE/ER/10028—T1) Pseudo-spectral calculations of shock waves, rarefaction waves, and contact surfaces. Final report.** Taylor, T.D.; Myers, R.B.; Albert, J.H. (Aerospace Corp., El Segundo, CA (USA)). 1 Oct 1980. Contract AC01-79ER10028. 11p. NTIS, PC A02/MF A01. Order Number DE82015139.

The selection-rule filtering techniques were applied to one-dimensional flows. The tests have shown that problems with spectral expansion behavior near steep gradients can be overcome.

58402 **(HU-TFT—81-14) Quasiclassical theory of ions in ^{3}HE.** Thuneberg, E.V.; Kurkijaervi, J.; Rainer, D. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702700.

The quasiclassical equations for the quasiparticle propagator in superfluid ^{3}He are formulated in the presence of a strong localized potential and solved for an ion in the B-phase. The loss in condensation energy occasioned by the ion is calculated and evaluated numerically for a hard sphere scattering model of the ion. The effects of more general quasiparticle scattering properties are discussed.

58403 **(KFKI—1980-114) Cluster perturbation theory for classical fluids. I.** Kollar, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1980. 25p. B, MF A01. Order Number DE82902731.

Portions of document are illegible.

A perturbational method in the form of a power series in a softness prameter Ξ has been developed for determining the thermodynamic properties and the pair correlation function of a real fluid using the thermodynamic quantities and distribution functions of a reference system. The method makes possible a simple treatment for the higher order terms and enables us to take into account some parts of the higher order terms in the usual density-dependent form of the thermodynamic quantities, in terms of lower order terms, namely those parts, that can be expressed in terms of the dervatives of lower order distribution functions with respect to the density. Thus we expect to achieve higher accuracy compared to the usual treatments in the case, when we know, for example, only the pair correlation function of the reference system, since the method makes full use of the information content of the pair function. Besides, new conditions have been proposed for the optimal choice of the reference system.

58404 **Theory of the shock process in dense fluids.** Wallace, D.C. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **25**: No. 6, 3290-3301(Jun 1982).

A shock is assumed to be a steady plane wave, and irreversible thermodynamics is assumed valid. The fluid is characterized by heat conduction and by viscous or viscoelastic response, according to the strain rate. It is shown that setting the viscosity zero produces a solution which constitutes a lower bound through the shock process for the shear stress, and upper bounds for the temperature, entropy, pressure, and heat current. It is shown that there exists an upper bound to the dynamic stresses which can be achieved during shock compression, that this bound corresponds to a purely elastic response of the fluid, and that solution for the shock process along this bound constitutes lower bounds for the temperature and entropy. It is shown that a continuous steady shock is possible only if the heat current is positive and the temperature is an increasing function of compression almost everywhere. In his theory of shocks in gases, Rayleigh showed that there is a maximum shock strength for which a continuous steady solution can exist with heat conduction but without viscosity. Two more limits are shown to exist for dense fluids, based on the fluid response in the leading edge of the shock: for shocks at the overdriven threshold and above, no solution is possible without heat transport; for shocks near the viscous fluid limit and above, viscous fluid theory is not valid, and the fluid response in the leading edge of the shock is approximately that of a nonplastic solid. The viscous fluid limit is estimated to be 13 kbar for water and 690 kbar for mercury.

58405 **Third sound in layered superfluids: Harrow-down on ^{4}He.** Guyer, R.A.; Miller, M.D. (Laboratory for Low Temperature Physics, Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01003). *Physical Review [Section] B: Condensed Matter;* **25**: No. 9, 5749-5755(1 May 1982).

In order to minimize the possibility of spin flips due to interactions with and on the walls of a sample cell, spin-polarized hydrogen (Harrow-down) is studied in a ^{4}He sample cell, i.e., a sample cell which has been coated with a film of superfluid ^{4}He. At low temperatures it is expected that the most dense Harrow-down sample will first form in the physisorbed state on the ^{4}He film. In this paper we examine in detail the hydrodynamic consequences of this lyered film configuration. We derive the expression for third sound in the general case that the films are compressible and both films have undergone superfluid transitions. In this case two propagating modes will be seen which will provide an unequivocal demonstration of a superfluid transtion in the Harrow-down film. We specialized to various limiting cases: incompressible films, saturated and unsaturated films, and the normal fluid Harrow-down blanket. In our discussion we stress the point that even if the Harrow-down has not gone superfluid it will still shift the ^{4}He third-sound speed, that this shift is a direct measure of the Harrow-down film areal density, and that the magnitude of this shift is expected to be well within the precision of present-day third-sound eperimental techniques. Thus third sound is expected to be a primary diagnostic tool in the study of Harrow-down films.

58406 **Elliptic-vortex method for incompressible flow at high Reynolds number.** Teng, Z. (Department of Mathematics, Peking University, Peking, China). *Journal of Computational Physics;* **46**: No. 1, 54-68(Apr 1982). Contract W-7405-ENG-48.

An elliptic-vortex model for approximating the time-dependent Navier-Stokes equations at high Reynolds number is presented. One attractive feature of the new method is that the elliptic-computational elements used in this model are very good for boundary layer flow. Also introduced are a modified boundary algorithm and a new outflow boundary condition. Numerical computations for flat-plate problems show that the new method converges very fast and the numerical results are in excellent agreement with known facts.

58407 **Solution of the time-dependent inertial-frame equation of radiative transfer in moving media to O(v/c).** Mihalas, D.; Klein, R.I. (Sacramento Peak Observatory, Sunspot, New Mexico 88349). *Journal of Computational Physics;* **46**: No. 1, 97-137(Apr 1982). Contract W-7405-ENG-48.

A stable and efficient mixed-frame method has been formulated for the solution of the time-dependent equation of radiative transfer with full retention of all velocity dependent terms to O(v/c). The method retains the simplicity of the differential operator found in the inertial frame while transforming the absorption and emission coefficients to the comoving frame keeping them isotropic. The method is ideally suited to continuum calculations. To correctly treat the time dependence of the radiation field over fluid-flow time increments, the velocity-dependent terms on the right-hand side of both the transfer and moment equations must be retained for consistency.

58408 **Statistical mechanics via the method of complementary variational principles. I. Application to classical, two-dimensional fluids.** MacCarthy, J.E.; Kozak, J.J. (Univ. of Notre Dame, IN). *Molecular Physics;* **44**: No. 3, 761-781(1981).

A new, versatile, theoretically self-consistent procedure is proposed for determining the thermodynamic properties of a classical system in the condensed fluid phase. The method of complementary variational principles, developed by A.M. Arthurs and his colleagues, is used to generate reference state (hard core) correlation function data via analysis of a well known (non-linear) integral equation for the pair distribution function (namely, the Yvon-Born-Green equation). These data are then used within the context of the perturbation theory of classical fluids developed by Zwanzig, as implemented by Barker and Henderson, to investigate the role of attractive and repulsive perturbations in influencing the thermodynamics of the reference system. As a specific application of this procedure, one that leads to many new results, we focus on a classical system of particles whose effective interactions are confined to a space of two dimensions. We consider two classes of potential functions (the square well/square shoulder and linear well/linear shoulder potentials) and consider separately the effects of attractive and repulsive perturbations.

58409 **Quasi-three-dimensional modeling of flow in MHD channels.** Ahluwalia, R.K.; Doss, E.D. (Argonne National Lab., IL). *Numerical Heat Transfer;* **3**: 67-87(Jan 1980).

A set of two-dimensional turbulent boundary-layer equations that describe the three-dimensional fluid flow in a magnetohydrodynamic channel is outlined. The equations are solved by an implicit finite-difference scheme a method of calculating the pressure gradient is used that avoids the need to iterate over the coefficients of the difference equations. The numerical method is tested by applying it to low and high-speed flows over a flat plate. It is shown that the governing equations fully satisfy the three-dimensional conservation laws. The importance of accounting for three-dimensional effects is assessed, and an advanced technique for bringing out better the interaction between the boundary layers on sidewalls and electrode walls is discussed.

58410 **Sphere drag at Mach numbers from 0.3 to 2.0 at Reynolds numbers approaching 10^7.** Miller, D.G. (Univ. of California, Livermore); Bailey, A.B. *Journal of Fluid Mechanics;* **93**: 449-464(1979). Contract W-7405-ENG-48.

The analysis of 18th and 19th century cannon firings shows that knowledge of sphere drag can be substantially extended into the region of 0.3 ≦ M/sub infinity/ ≦ 2.0 and Re/sub infinity d/ up to 10^7. Bashforth's chronographic measurements (1868) are of a quality comparable to modern measurements. The data of Mayevski (chronograph, 1868), Hutton (ballistic pendulum 1787 to 1791), and Didion (ballistic pendulum, 1839 to 1840) are of lesser accuracy but in agreement with Bashforth's. These cannon data are combined with modern data to provide the most extensive curves available of C/sub D/ vs Re/sub infinity d/ in this region. Interesting features of these curves for M/sub infinity/ ≦ 1.0 are briefly described.

58411 **Simulation of three-dimensional MHD duct flow.** Ahluwalia, R.K.; Doss, E.D. (Argonne National Laboratory, Argonne, Ill.). pp 195-228 of National Conference on Numerical Methods in Heat Transfer, 1st, University of Maryland, College Park, Md., September 24-26, 1979, Proceedings. Shih, T.M. College Park, MD; University of Maryland (1979).

From National conference on numerical methods in heat transfer; College Park, MD, USA (24 Sep 1979).

A set of two-dimensional turbulent boundary layer equations that describes the three-dimensional fluid flow in a magnetohydrodynamic channel is outlined. The equations are solved by an implicit finite difference scheme. A method of calculating the pressure gradient is used that avoids the need to iterate over the coefficients of the difference equations. The numerical method is tested by applying it to slow- and high-speed flows over a flat plate. It is shown that the governing equations fully satisfy the three-dimensional conservation laws. The importance of accounting for three-dimensional effects is assessed, and an advanced technique for bringing out better the interaction between the boundary layers on sidewalls and electrode walls is discussed.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 57083, 58590

58412 **(CERN—81-18) Progress report on CERN activities (June 1981).** Schopper, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 7 Dec 1981. 40p. (In French). NTIS (US Sales Only), PC A03/MF A01; Translated from the English original CERN--81-17. Order Number DE82702011.

A selection of subjects illustrates the results obtained at CERN, especially during the first half-year of 1981. The report deals mainly with the development of installations for the storage and the acceleration of antiprotons and for the realization of collisions between beams of antiprotons and protons. The other developments of accelerators and particle detectors are equally mentioned. Thereafter the general aspect of our actual knowledge of the constituents of matter and the forces acting between them is analyzed. This framework is used for the presentation of the experimental results obtained at CERN. The evoked questions include the tests of the quark-parton model, the properties of the new particles containing charmed or beauty quarks, the studies of the structure of the nucleon, the tests of quantum chromodynamics (QCD), and the research on the weak interaction.

58413 **(CERN—81-19) Bruno Touschek legacy. Vienna 1921-Innsbruck 1978.** Amaldi, E. (European Organization for Nuclear Research, Geneva (Switzerland)). 23 Dec 1981. 88p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82702012.

A biographical portrait of Bruno Touschek, an Austrian physicist who, before and during the Second World War, went through the dramatic adventures of a non-pure arian young person. Later he worked in Germany, Great Britain and Italy. Touschek was the first to propose chiral symmetry. He was the initiator and main driving force in the early developments of $e^+ e^-$ colliding machines. His wide scientific culture, his ingenuity and enthusiams for any new challenging problem and the search of its solution were essential elements in determining the extraordinary influence Bruno had on the work of his younger colleagues. 'He led an intense and vigorous life and by his example and friendliness helped many colleagues and friends to achieve greater happiness and awareness in their own lives'.

58414 **Proton-antiproton collider physics, 1981.** Barger, V.; Cline, D.; Halzen, F. (eds.). New York, NY; American Institute of Physics (1982). 684p. (CONF-811231—). American Institute of Physics, 335 E. 45th Street, New York, NY 10017.

From Forward collider workshop; Madison, WI, USA (10 Dec 1981).

Particles and Fields Subseries No. 26.

The papers presented were entered in the data base separately. (WHK)

58415 **Topical conference on the application of microprocessors to high-energy-physics experiments: proceedings.** Geneva, Switzerland; European Organization for Nuclear Research (1981). 623p. (CERN—81-07; CONF-810539—). CERN, Geneva, Switzerland.

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Portions of document are illegible.

A topical conference on the Application of Microprocessors to High-Energy-Physics Experiments was held at CERN, May 4-6, 1981. These proceedings contain the unedited manuscripts of invited talks, contributed papers and posters received from the authors.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 57847, 57968, 58511, 58606, 58606, 58629

58416 **(EFI—467(9)-81) Spectra of cumulative protons in the γ12 C (yields) PX process at γ -quanta maximum energy 4.5 GeV.** Alanakian, K.V.; Amarian, M.J.; Demirchian, R.A.; Egiyan, K.Sh.; Karumian, J.V.; Kocharova, Zh.L.; Ogandjanian, M.S.; Sharabian, Yu.G. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 23p. NTIS (US Sales Only), PC A02/MF A01.

Experimental energy and angular distributions of inclusive photoprotons produced on ^{12}C by bremsstrahlung γ-quanta with maximum energy 4.5 GeV, at proton detection angle 20-120 deg and momenta 0.4-1.3 GeV/c are presented. It is shown that in the case of cumulative production the energy distributions of photoprotons are described well by the exponential, whereas for non-cumulative protons the spectrum is flattened out in the high-energy region. The experimental data obtained are analysed from the viewpoint of three theoretical models trying to explain the cumulative production of particles on nuclei.

58417 **(FRNC-TH—1061) Production of events with two or three muons in the final state during the interaction on nucleons of neutrinos and anti-neutrinos of the CERN narrow band beam with a maximum energy of 200 GeV.** Maillard, J. (Paris-6 Univ., 75 (France)). Mar 1979. 255p. (In French). NTIS (US Sales Only), PC A12/MF A01.

Thesis.

A study was made of the production of dimuons and trimuons in the neutrino interactions using the data of the CDHS (CERN-Dortmund-Heidelberg-Saclay Cooperation) experiment taken in the CERN narrow band beam. The analysis of the quick results (since the statistics are weak) leads to significant conclusions on these events: 1) the c quark fragmentation function is approximately flat, 2) the production of heavy leptons, if this exists, only represents a very small part of the charged currents (10^{-4} approximately). 3) the pair production of charmed quarks can explain some of the dimuons of same sign, the greater part of these events coming from the semi leptonic disintegration of pions and kaons ($\pi \rightarrow \mu\nu, K \rightarrow \mu\nu$) produced in the hadronic jet. 4) any other process (for instance the production of b quarks) is very weak ($< 10^{-3}$ of the charged currents).

58418 **(HU-P—192) Inclusive Σip (1385) production in anti pp interactions at 12 GeV/c.** Karimaeki, V.; Kinnunen, R.; Korkea-aho, M. (Helsinki Univ. (Finland). Dept. of High Energy Physics). Jan 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702710.

Inclusive production of Σ^{+-}(1385) resonances is studied in antipp interactions at 12 GeV/c. The cross sections for Σ^{+}(1385)+cc and Σ^{-}(1385)+cc are determined to be 251 +- 38 μb and 123 +- 30 μb, respectively. The inclusive spectra are presented as a function of Feynman x, c.m. rapidity and the squared transverse momentum psub(T)sup(2). Significant differences with the corresponding pp data are found in the longitudinal momentum distributions. The qualitative features of the production can be explained by simple quark ideas.

58419 **(IFVE-OEIPK—81-72) Comparison of strange antibaryon and strange meson production in K^{+} p interactions at 32 GeV/c.** Chliapnikov, P.V.; Gerdyukov, L.N.; Khromova, G.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 17p. NTIS (US Sales Only), PC A02/MF A01.

New experimental results are presented on inclusive production properties of anti Σsup(*+)(1385) and anti Σsup(*-) (1385) in K^{+} p interactions at 32 GeV/c. The analysis is based on significantly larger statistics than previously available. A comparison is made of invariant x-distributions of K^{0}/ anti K^{0}, anti Λ and anti Ξ^{+} and of anti Σsup(*+-) (1385) and Ksup(*+) (892). These spectra exhibit regularities expected from the quark-recombination picture when it is assumed that the strange mesons and antibaryons are produced off the strange anti s- valence quark in the incident K^{+} meson. Transverse momentum distributions are also presented for Ksup(*+) (892) and anti Σsup(*+-) (1385) and found to be very similar. The results on strange antibaryon average multiplicities disagree strongly with a recent version of the additive quark model.

58420 **(IFVE-OEIPK—81-111) Study of inclusive production of πip mesons and protons in pp interactions at 32 GeV/c.** Vlasov, E.V.; Babintsev, V.V.; Bumazhnov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 53p. (In Russian). (SERP-E—122). NTIS (US Sales Only), PC A04/MF A01.

Results are presented on the inclusive production of π^{+-} mesons and protons in anti pp interactions at an incident antiproton momentum of 32 GeV/c in Mirabelle, based on a sample of 55,000 of inelastic events. The spectra of π^{+} (π^{-}) and p are separated in the whole kinematically admitted region of phase space by a statistical method. The semi-inclusive and inclusive cross sections and the main average characteristics of the π^{+} and p production are calculated. The invariant differential cross sections are studied as functions of the Feynman scaling variable x, the rapidity and the transverse momentum psub(T). The analysis of the form of the invariant x- distributions of π^{+-} mesons in the proton fragmentation region shows no significant contributions from the processes with quark exchange or annihilation. For psub(T)sup(2)>1 (GeV/c)sup(2) there is an evidence of the effects from the hard quark scattering on mesons or baryons.

58421 **(IFVE-OEIPK—81-112) Study on longitudinal correlations between pions in fragmentation regions of primary hadrons in K^{-} p interactions at 32 GeV/c.** Bumazhnov, V.A.; Gumenyuk, S.A.; Moiseev, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 31p. (In Russian). (SERP-E—77). NTIS (US Sales Only), PC A03/MF A01.

Longitudinal correlations between pions inclusively produced in the target and beam fragmentations are studied in inclusive K^{-} p experiment at 32 GeV/c. The analysis of the differential distributions of chaAged pions, produced in the proton fragmentation region under other charged pion trigger reveals an absence of x_2-scaling. Two- and three pions longitudinal center-of-mass distributions are also studied and their behaviour showed a significant deviation from the simple quark recombination predictions. Significant long-range correlations, found between momenta of π^{-} mesons from the proton fragmentation and of π^{+} mesons from the K^{-} fragmentation, can be an indication of the existence of the quark exchange or quark annihilations in the initial K^{-} p collisions.

58422 **(IFVE-ONF—81-71) Inclusive Ksup(*+)(1430), Ksup(*0)(1430) and f(1270) production in K^{+} p interactions at 32 GeV/c.** Chliapnikov, P.V.; Falaleev, V.P.; Gerdyukov, L.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 31p. NTIS (US Sales Only), PC A03/MF A01.

Results are presented on total and semi-inclusive cross sections structure functions, longitudinal and transverse momentum and particle rapidity distributions of the tensor mesons Ksup(*+)(1430), Ksup(*0)(1430) and f(1270) observed in K^{+}p interactions at 32 GeV/c. The data are compared with Ksup(*+)(892), Ksup(*0)(896) and rho^{0} vector meson production in the same experiment. In agreement with quark-recombination ideas the shapes of inclusive invariant x-spectra for the strange vector and tensor mesons are found to be rather similar, after removal of diffractive and quasi- two-body channels.

58423 **(IFVE-ONF—81-94) Quark jets from antineutrino interactions. 2. Inclusive particle spectra and multiplicities in the quark jets.** Ammosov, V.V.; Denisov, A.G.; Gapienko, G.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 23p. NTIS (US Sales Only), PC A02/MF A01.

The results on inclusive particle production in the antineutrino charged current induced hadron jets observed in the Fermilab 15- ft. bubble chamber are presented. Fractional energy distributions, particle ratios and average multiplicities of the hadrons in the jets are measured. Ratios between the inclusive production rates of different mesons in the jets are studied to seek evidence for the d-quark origin of the observed hadrons. Good over-all agreement with the hypothesis of d-quark fragmentation with universal fragmentation functions obeying isospin systematics is established.

58424 **(ITEF—88(1981)) Properties and interactions of neutrino (1977-1980) beam dump experiments.** Tsukerman, I.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

Data on search of instantaneous muon and electron neutrinos in experiments of beam dump type are presented in the review. Neutrino is formed in decays of particles rusulted from pN interactions. First experiments of the dump beam type have been realized at the CERN/SPS accelerator in 1975 and Serpukhov accelerator by the ITEF-IFVE group in 1977 with proton energies of 26 and 70 GeV, respectively. The results of beam dump experiments of the second generation in 1979 in CERN are considered in detail. These experiments have been intended for measuring the effect of instantaneous neutrino. The conclusion is drawn on the presence of instantaneous muon neutrinos in the above experiments.

58425 (JINR—R-1-81-429) Sources of leading pions in πip and π^-p interactions at 16 and 40 GeV/c. Bekker, L.; Grishin, V.G.; Kvatadze, R.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The source of leading charged pions in π^+p and π^-p interactions at 16 and 40 GeV/c, respectively, is studied. We obtain that approximately 50-60 percent of all leading particles (Xsub(πsub(L))>0.4) with a charge opposite to that of incident pion come from the decay of rho^0, f and g resonances. The probability of double inelastic exchange decreases with increasing Xsub(πsub(L)) and weakly depends on the energy and charge of incident π-meson.

58426 (JINR—R-1-81-437) Inclusive production of πp mesons in np interactions at 3.83 GeV/c. Abdivaliev, A.; Besliu, K.; Gasparyan, A.P.; Gruia, S.; Ierusalimov, A.P.; Cotorbaj, F.; Moroz, V.I.; Nikitin, A.V.; Troyan, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

Data on the production of π^- mesons in np interactions at neutron momentum Psub(n)=3.83 GeV/c are presented. The experimental data has been obtained by irradiating the one-meter hydrogen bubble chamber with a monochromatic neutron beam. 13000 of 3- and 5-prong stars were processed. Experimental inclusive characteristics of π^- mesons are studied. Transverse momentum square distribution of π^- mesons, momentum and angular distribution of π^- mesons as well as transverse momentum value dependence of π^- meson on rapidity in the laboratory system are given.

58427 (JINR—R-1-81-496) Some methodical problems of interference investigation of identical pions produced in multiparticle processes at high energy. Angelov, N.; Akhababyan, N.; Grishin, V.G.; Kvatadze, R.A.; Koval'ski, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

Some methodical problems emerging at investigation of space- time characteristics of radiation region of secondary pions, produced in hadron-hadron, hadron-nucleus and nucleus-nucleus collisions at high energy are discussed. Simulating the effect of interference in the conditions of real experiment, the limits of the possibility of source region dimensions are determined. In this way, the influence of the normalization of distributions in the evidence of the effect is investigated. In the basis of multicluster model of hadron-hadron interaction, the formation of background distributions by the pions transposition of different events does not deform the parameters of the source region dimensions.

58428 (JINR—R-1-81-542) Comparison of the jet behaviour of hadrons in πsup(-1) interactions at 40 GeV/c with hadron production in e^+e^- annihilation. Grishin, V.G.; Didenko, L.A.; Kanarek, T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

Analysis of multiple hadron production in π-p-interactions at 40 GeV/c by means of variables characterizing the jet behaviour of hadrons in the final state "sphericity" (S) and thrust (T) is performed. The results of the analysis of π-p-interactions obtained are compared with analogous data relating to e^+e^- annihilation. For secondary particles distributions of events on sphericity, thrust variables and those characterizing transversal jet dimensions are given. It is concluded that basic characteristics of the hadron jet behaviour in the final state are the same in both types of interactions with the inertia center energy E=10 GeV.

58429 (JINR—R-2-81-487) Scaling of the rapidity distributions in the πpp interactions at Psub(πsup(-))=40 GeV/c. Lyubimov, V.B.; Omboo, Z.; Tuvdendorzh, D.; Uzhinskij, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The experimental data on the inelastic $\pi^- + p \rightarrow n\pi^+ + X$ and $\pi^- + p \rightarrow n\pi^- + X$ interactions at Psub(πsup(-))=40 GeV/c obtained in the two-meter JINR propane bubble chamber are analyzed. The rapidity distributions of the secondary $\pi^-(\pi^+)$ pions are presented for different partial elasticity coefficients Ksup(+-)=ΣEsub(πsup(+))/√S, where √S - the total c.m.s. energy of a bombarding pion and a target proton, Esub(πsup(+-)) - the c.m.s. energy of $\pi^+(\pi^-)$. The distributions of π^+ and π^- differ at all k. The distributions of π^+ at $k^+ > 0.2$ are reminiscent. In the $\pi^+(\pi^-)$ distributions for the events with ksup(+-)>0.2 there is a plateau the width of which increases with increasing Ksup(+-). The height of the plateau depends significantly on diffraction processes. When the diffraction events are put away the π^+ and π^- characteristics become closer.

58430 (NP—2903591) Scalar mesons and their production in $\gamma\gamma$ scattering. Mennessier, G. (Montpellier-2 Univ., 34 (France)). Jun 1981. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82903591.

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Two typical fits are done of the data on the $\pi\pi$ S-waves (I=o), with or without narrow S*, from threshold up to 1.4 GeV. For both, the I=o S and D - wave final state interaction in $\gamma\gamma$ production of $\pi\pi$ and K anti K is calculated in a unitary, analytic formalism. We give the differential cross sections as a function of some parameters related to direct epsilon, S* and f(1270)-$\gamma\gamma$ couplings. In the low energy range, the unitarized Born contribution is in average smaller than the Born one, and the results of the DCI experiment then indicate the need for a direct epsilon $\gamma\gamma$ coupling. Near 1 GeV, there is an effect related to the KK threshold, and more precise data could allow to decide whether a narrow S* exists or not. In the f range, we expect the $\pi^0\pi^0$ peak near 1.29 GeV when $\pi + \pi^-$ peaks at 1.24 GeV.

58431 Measurements of spin parameters in p-p elastic scattering at 6 GeV/c. Linn, S.L.; Perlmutter, A.; Crosbie, E.A.; Ratner, L.G.; Schultz, P.F.; O'Fallon, J.R.; Cameron, P.R.; Crabb, D.G.; Fernow, R.C.; Hansen, P.H.; Krisch, A.D.; Salthouse, A.J.; Sandler, B.; Shima, T.; Terwilliger, K.M. (Department of Physics and Center for Theoretical Studies, The University of Miami, Coral Gables, Florida 33124). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 3, 550-556(1 Aug 1982).

We measured the differential cross section for proton-proton elastic scattering in 6 GeV/c, with both initial spins oriented normal to the scattering plane. The analyzing power A shows significant structure with a large broad peak reaching about 24% near P/sub perpendicular/ ^{2} = 1.6 (GeV/c)^2. The spin-spin correlation parameter A/sub n/n exhibits more dramatic structure, with a small but very sharp peak rising rapidly to about 13% at 90^0/sub tsc.m./. This sharp peak may be caused by particle-identity effects.

58432 Antiproton-proton and proton-proton elastic scattering at 100 and 200 GeV/c. Kaplan, D.H.; Karchin, P.; Orear, J.; Kalbach, R.M.; Krueger, K.W.; Pifer, A.E.; Baker, W.F.; Eartly, D.P.; Klinger, J.S.; Lennox, A.J.; Rubinstein, R.; McHugh, S.F. (Cornell University, Ithaca, New York 14853). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 3, 723-725(1 Aug 1982).

Antiproton-proton elastic scattering has been measured at 100 GeV/c for $0.5<-t<2.5$ (GeV/c)^2 and at 200 GeV/c for $0.9<-t<4$ (GeV/c)^2. The data show that the $-t \cong 1.4$ (GeV/c)^2 dip recently observed at 50 GeV/c persists to higher incident momenta. Proton-proton measurements made at the same beam momenta show similar structure.

58433 Search for exclusive free-quark production in e^+e^- annihilation. Marini, A.; Peruzzi, I.; Piccolo, M.; Ronga, F.; Chew, D.M.; Ely, R.P.; Pun, T.P.; Vuillemin, V.; Fries, R.; Gobbi, B.; Guryn, W.; Miller, D.H.; Ross, M.C.; Besset, D.; Freedman, S.J.; Litke, A.M.; Napolitano, J.; Wang, T.C.; Harris, F.A.; Karliner, I.; Parker, S.; Yount, D.E. (Laboratori Nazionali di Frascati dell'Istituto Nazionale di Fisica Nucleare, I-00044 Frascati, Rome, Italy). *Physical Review Letters;* **48**: No. 24, 1649-1652(14 Jun 1982).

The products of e^+e^- annihilation have been searched at 29-GeV center-of-mass energy for free fractionally charged particles produced in exclusive two-body final states. No evidence for fractionally charged quarks was found and the upper limits on the ratio R/sub q/q-bar = σ/sub q/q-bar/σ/sub mumu-bar/ are below 1% for quarks with charges 1/3 e or 2/3 e and masses below about 14 GeV/c^2. This is the first reported limit for charge 1/3 e. Long-lived fractionally charged leptons are definitely ruled out over a significant range of masses.

58434 **Measurement of the branching fraction for the Cabibbo-suppressed decay tau$^-$→K$^-$ ν/sub tau/.** Blocker, C.A.; Abrams, G.S.; Alam, M.S. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review Letters;* **48**: No. 23, 1586-1589(7 Jun 1982). Contract AC03-76SF00515;W-7405-ENG-48.

The branching fraction for the Cabibbo-supressed decay tau$^-$→K$^-$ ν/sub tau/ is measured from data obtained with the Mark II detector at SPEAR. Fifteen events containing a K^{+-} in coincidence with a muon or electron of opposite charge are observed. It is determined that B(tau$^-$→K$^-$ ν/sub tau/) = (1.3 +- 0.5)%.

58435 **Observation of semileptonic decays of charmed baryons.** Vella, E.; Trilling, G.H.; Abrams, G.S.; Alam, M.S.; Blocker, C.A.; Blondel, A.; Boyarski, A.M.; Breidenbach, M.; Burke, D.L.; Carithers, W.C.; Chinowsky, W.; Coles, M.W.; Cooper, S.; Dieterle, W.E.; Dillon, J.B.; Dorenbosch, J.; Dorfan, J.M.; Eaton, M.W.; Feldman, G.J.; Franklin, M.E.B.; Gidal, G.; Goldhaber, G.; Hanson, G.; Hayes, K.G.; Himel, T.; Hitlin, D.G.; Hollebeek, R.J.; Innes, W.R.; Jaros, J.A.; Jenni, P.; Johnson, A.D.; Kadyk, J.A.; Lankford, A.J.; Larsen, R.R.; Lueth, V.; Millikan, R.E.; Nelson, M.E.; Pang, C.Y.; Patrick, J.F.; Perl, M.L.; Richter, B.; Roussarie, A.; Scharre, D.L.; Schindler, R.H.; Schwitters, R.F.; Siegrist, J.L.; Strait, J.; Taureg, H.; Tonutti, M.; Vidal, R.A.; Videau, I.; Weiss, J.M.; Zaccone, H. (Stanford Lilnear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review Letters;* **48**: No. 22, 1515-1518(31 May 1982). Contract AC03-76SF00515;AC03-76SF00098.

Direct electrons are observed in baryon events produced in e$^+$e$^-$ annihilation at center-of-mass energies above the Λ/sub c/ Lambda-bar/sub c/ threshold. These events are attributed to charmed baryon pair production and subsequent Λ/sub c/ semileptonic decay. Various semileptonic branching ratios of the Λ/sub c/ are determined, including BR(Λ/sub c/→e$^+$X) = (4.5 +- 1.7)%.

58436 **Lifetimes of charmed particles produced in a 20-GeV γp experiment.** Abe, K.; Bacon, T.C.; Ballam, J. (Birmingham University, Birmingham B15 2TT, England). *Physical Review Letters;* **48**: No. 22, 1526-1529(31 May 1982).

Eleven neutral and nine charged decays of charmed particles have been observed in a sample of 205 000 hadronic interactions in a 1.2-million-picture exposure of the SLAC Hybrid Facility bubble chamber to a 20-GeV/c backward-scattered laser beam. The charged and neutral lifetimes were determined to be 8.2/sup +4.5//sub -2.5/ x 10^{-13} and 6.7/sup +3.5//sub -2.0/ x 10^{-13} sec, respectively, with a ratio of 1.2/sup +0.9//sub -0.5/.

58437 **Test of high p/sub T/ scaling from cosmic-ray interactions up to 400 TeV.** Hazen, W.E.; Hendel, A.Z.; Ash, A.G.; Foster, J.M.; Hodson, A.L.; Porter, M.R.; Bull, R.M. (Randall Laboratory of Physics, University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters;* **48**: No. 22, 1562-1564(31 May 1982).

The rate of subcores in cosmic-ray air showers has been measured near sea level with a close-packed 35-m^2 array of spark chambers at Leeds. Auxiliary experiments demonstrate that our transition effects are negligible. The rate of subcores versus shower size is translated into the rate of high p/sub T/ events versus energy of the interacting hadron. Comparison with calculations of Halzen favors p/sub T/$^{-4}$ over p/sub T/$^{-8}$ scaling. The highest energy bin is centered on 350 TeV.

58438 **Determination of the fundamental parameters of the K^0-K-bar^0 system in the energy range 30—110 GeV.** Aronson, S.H.; Bock, G.J.; Cheng, H.; Fischbach, E. (Accelerator Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **48**: No. 19, 1306-1309(10 May 1982).

K^0 regeneration data in the energy range 30—110 GeV have been analyzed to determine the values of the K/sub L/-K/sub S/ mass difference, Δm, K/sub S/ lifetime, tau/sub S/, and CP nonconservation parameter eta/sub +/-. We find Δm = 0.482(14) x 10^{10}h s^{-1}, tau/sub S/ = 0.905(7) x 10^{-10} s, 'eta/sub +/-' = 2.09(2) x 10^{-3}, and tanphi/sub +/- = 0.709(102), corresponding to phi/sub +/- = 35(4)°. The data suggest that these parameters may have an anomalous energy dependence.

58439 **Amplitude analysis of the reaction πiπ^-→$\pi^0\pi^0$ from 1.0 to 2.3 GeV.** Cason, N.M.; Biswas, N.N.; Baumbaugh, A.E.; Bishop, J.M.; Cannata, P.E.; Dauwe, L.J.; Kenney, V.P.; Ruchti, R.C.; Shephard, W.D.; Watson, J.M. (University of Notre Dame, Notre Dame, Indiana 46556). *Physical Review Letters;* **48**: No. 19, 1316-1319(10 May 1982).

An amplitude analysis of $\pi^+\pi^-$→$\pi^0\pi^0$ scattering from the reaction π^+p→$\Delta^{++}\pi^0\pi^0$ has been carried out between 1.0 and 2.3 GeV. The data are consistent with only one of the four π-π phase-shift solutions determined from $\pi^+\pi^-$→$\pi^+\pi^-$ data. A new J/sup P/C = 2^{++} state at 1800 MeV with a width of 280 MeV is observed.

58440 **Inelastic scattering of high energy muons from nuclear targets.** Miller, M.T. Rochester, NY; Rochester Univ. (1981). 148p. University Microfilms Order No.81-23,992.

Thesis (Ph. D.).

The inelastic cross section of high energy muons from nuclear targets were measured. It was performed using a 10.5 GeV muon beam and a system of multiwire proportional chambers. The energy range was explored and it was found that in most cases muons scatter incoherently from the individual nucleons in the nucleus. However, for a small fraction of the events the nucleons shadow one another resulting in a cross section sigma sub T is approximately sigma sub NA rho where A is the atomic number of the nuclear target. This 'shadowing' effect is attributed to the strongly interacting component of the exchanged virtual photon and its magnitude was found to be in excess of the predictions of current theoretical models.

58441 **Charmonium studies with the Crystal Ball.** Oreglia, M. (Stanford Linear Accelerator Center, CA (USA)). pp 69-82 of Electroweak interactions and unified theories. Proceedings v.2 of the 15. Rencontre de Moriond, les Arcs, 9 - 21 March 1980. Tran Thanh Van, J. (ed.). Dreux, France; Editions Frontieres (1980).

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

The Crystal Ball detector at SPEAR is used to analyze the decays psi' → $\gamma\gamma$psi and psi' → γchi,chi → $\gamma\gamma$. Values are obtained for the branching ratio of psi' → eta/π^0psi and psi' → γchi, chi → γpsi. No evidence is found for a 2^1S_0(eta'(c)) state in the mass range 3129 → 3644 MeV/c^2. Analysis of the angular distributions in the cascade chi decays yields spin and multipole assignments for the chi(3.51) and chi(3.55).

58442 **Radiative decays of the psi and psi'.** Aschman, D. (Stanford Linear Accelerator Center, CA (USA); Princeton Univ., NJ (USA)). pp 83-94 of Electroweak interactions and unified theories. Proceedings v.2 of the 15. Rencontre de Moriond, les Arcs, 9 - 21 March 1980. Tran Thanh Van, J. (ed.). Dreux, France; Editions Frontieres (1980).

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

The status of the eta(c) signal seen in the Crystal Ball data on psi' and psi radiative decay is presented. The eta(c) has a mass of (2981 +- 15) MeV, and a width of 20 +- 15 MeV. The decay mode eta(c) → eta$\pi\pi$ is observed by fitting to exclusive events. Data on other radiative decays of the psi show evidence for the E(1420) meson.

58443 **psi radiative decays.** Feldman, G.J. (Stanford Linear Accelerator Center, CA (USA)). pp 95-106 of Electroweak interactions and unified theories. Proceedings v.2 of the 15. Rencontre de Moriond, les Arcs, 9 - 21 March 1980. Tran Thanh Van, J. (ed.). Dreux, France; Editions Frontieres (1980).

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

Inclusive and exclusive measurements of psi radiative decay are presented. The magnitude of hard inclusive radiative decay is comparable to the prediction of first order QCD, but the measured spectrum is considerably softer. In addition to measurements of radiative decays to the known pseudoscalar and tensor mesons, a sizable decay to a resonance of mass 1440 +10 -15 MeV/c^2 in the KantiKπ mode is observed. This may be the E(1420) meson. Supporting evidence is presented for the existence of the eta(c) at a mass of 2980 MeV/c^2.

58444 **Two-photon interactions from MARK II at SPEAR.** Hollebeek, R. (Stanford Linear Accelerator Center, CA (USA)). pp 107-116 of Electroweak interactions and unified theories. Proceedings v.2 of the 15. Rencontre de Moriond, les Arcs, 9 - 21 March 1980. Tran Thanh Van, J. (ed.). Dreux, France; Editions Frontieres (1980).

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

Results on the two-photon production of the eta', f(1270), A_2(1310), and f'(1515) mesons at SPEAR energies are presented using data taken with the Mark II detector. The radiative width of the eta' has been determined to be GAMMA$\gamma\gamma$(eta') = 5.8 +- 1.1 keV (20% systematic uncertainty). Upper limits for the radiative widths of the f, A_2, and f' have been determined.

58445 **Evidence for two body break up at a unique temperature in high energy P-Xe and P-Kr collisions.** Gaidos, J.A.; Gutay, L.J.; Hirsch, A.S.; Mitchell, R.; Ragland, T.V.; Scharenberg, R.P.; Turkot, F.; Willmann, R.B.; Wilson, C.L. pp 339-341 of Hadronic matter at extreme energy density. Cabibbo, N.; Sertorio, L. (eds.). New York, NY; Plenum Publishing Corporation (1980).

This experiment was conducted at FNAL. Using the newly developed warm gas jet facility, hydrogen-noble gas mixtures were injected into the circulating proton beam. During injection, the beam was accelerated between 20 to 400 GeV/c. The target mixtures reported here were 90% H_2 to 10% Xe and 82% H_2 to 18% Kr by partial pressures. Fragments, emerging from the interaction region, were accepted if they satisfied the ΔE . E . VETO trigger. A typical mass spectrum is shown. In attempting to find a mass independent disintegration temperature, we plotted the kinetic energy distributions for each fragment mass emerging from Xenon and Krypton. To our surprise, the inverse logaritmic slope, (temperature) varied between 15 and 20 MeV, about a factor of two larger than the nuclear binding energy.

58446 **(PB—82-157561) Jets and tests of qcd in e+ e- experiments.** Marshall, R. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 36p. (RL—81-087). NTIS, PC A03/MF A01.

This talk presents the current status of QCD tests using PETRA data. The paper is divided into three easy sections. The first section covers essentially qualitative comparisons using Q plots, thrust and P(T) distributions and energy or momentum flow. The second section describes the quantitative determination of (alpha sub s), and the third section covers the scalar-vector tests of QCD. (Copyright (c) Science and Engineering Research Council 1981.)

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REFER ALSO TO CITATION(S) 57968, 58307, 58541, 58543, 58559, 58569, 58571, 58579, 58605, 58630

58447 **(CEA-CONF—6003) Hard exclusive processes in the one - and two - nucleon systems.** Chemtob, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Sep 1981. 17p. (CONF-8109144—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702307.

From 6. international seminar on high energy physics problems: multiquark interactions and quantum chromodynamics; Dubne, USSR (15 Sep 1981).

A description of hard exclusive processes in the one-and two-nucleon system is attempted in the quark parton approach. The discussion deals with the large momentum transfer electromagnetic form factors of nucleon and deuteron as well as the wide angle, high energy nucleon-nucleon scattering differential cross-section and spin correlation parameters. We review the perturbative Quantum Chromodynamics approach initiated in recent works. The limitations of the approach are emphasized to motivate the consideration of a phenomenological approach. The core parton model introduced some time ago is discussed in both its spinless and spin versions. The predictions are compared with measurements.

58448 **(CNRS-CPT—81-P-1308) Parity violation in elastic N-N scattering at high energies.** Chiappetta, P.; Soffer, J.; Wu, T.T. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1981. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702309.

We calculate the asymmetry in nucleon-nucleon elastic scattering at high energies arising from heavy boson exchange in the standard Weinberg-Salam model. By neglecting the strong interaction enhancement effects, our result for p-n scattering is one order of magnitude higher than for p-p scattering. Enhancement effects increase the p-p asymmetry which may become comparable to the p-n asymmetry. They are however too small if compared with the total cross section asymmetry measured at Argonne at 6 GeV/c on a water target.

58449 **(DOE/ER/40048—13P2) Penetrating flavors.** McLerran, L.; Stodolsky, L. (Washington Univ., Seattle (USA). Dept. of Physics; Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). Dec 1981. Contract AC06-81ER40048. 13p. (MPI-PAE/PTH—77/81). NTIS, PC A02/MF A01. Order Number DE82020144.

Hadrons made of heavy flavor quarks are expected to have small cross sections and perhaps reduced energy loss in collisions, leading to their being more penetrating than ordinary hadrons. Some effects of this in cosmic ray phenomena are considered. If the heavy particle lives long enough it can become the dominant hadron component in the atmosphere. With particles of short lifetime there is a threshold effect in energy where the penetrating hadron travels far enough to become important. Some of the anomalous effects in 10^2 to 10^3 TeV phenomena could be caused via this mechanism by a particle with lifetime ~ 10^{-11} sec. An ~ 150 cm thick iron absorber would provide a substantial enhancement in the charm/proton ratio in the 10 to 100 TeV range. If free quarks are produced and have the same cross section as bound quarks, they act as highly penetrating hadrons.

58450 **(EFI—462(4)-81) Exotic baryon resonances with isospins (>=)5/2.** Grigoryan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 33p. NTIS (US Sales Only), PC A03/MF A01.

Properties of exotic baryon resonances a(I, S, eta) with isospins I>=5/2, whose existence follows from the dispersion sum rules for the reggeon-particle scattering amplitudes, are investigated. It is shown that the spins S of the states a(I, S, eta) are equal to isospins and intrinsic parities eta are positive. The expressions for the helicity vertex of a(I, S, eta) with Regge trajectories I=1 (rho, A_2, π) are found and the formula for their decay widths is derived. The experiments to search for the states a(I, S, eta) are discussed.

58451 **(EFI—464(6)-81) Inclusive spectra of Δii isobar in hadron-hadron collisions.** Arakelian, G.G.; Grigoryan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 22p. NTIS (US Sales Only), PC A02/MF A01.

The comparison of experimental data on Δ^{++}-isobar inclusive spectra in π^{+-}P,PP and anti PP-collisions with the predictions of reggeised π-meson exchange model OPER is carried out. The model describes qualitatively the majority of experimental data. The question of π^0N, $\pi\pi$, Kπ and $\gamma\pi$ total cross section extraction from the data on the inclusive spectra of Δ-isobar is discussed.

58452 **(HU-TFT—81-25) Localization of electrons by electron-electron interaction in an Anderson model.** Ritala, R.K.; Kurkijaervi, J. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1 Jun 1981. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702714.

We study the effect of attractive Hubbard interaction on disordered electron system. We map the interacting system back to noninteracting one and determine self-consistently the disorder change due to interaction in the system.

58453 **(HU-TFT—81-35) Models for polarization asymmetry in inclusive hadron production.** DeGrand, T.A.; Miettinen, H.I. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 18 Aug 1981. 34p. (UCSB-TH—27-1981). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702703.

The parton recombination model plus SU(6) symmetry is used to relate polarizations in inclusive baryon production to those of the underlying constituent subprocesses. A description of the origin of the polarization asymmetry in terms of Thomas precession of the quarks' spins in the recombination process accounts for all of the qualitative features of the baryon and anti-baryon polarization data.

58454 **(IC—79/5) Confinement, perturbation theory and Sterman-Weinberg jets.** Elias, V.; Rajpoot, S. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702013.

The total charge within the cones of Sterman-Weinberg jets is calculated to first order in perturbation theory in the integer-quark-charge model, a model free of infrared singularities. The same calculation is performed in conventional QCD (with fractionally charged quarks) and is finite in the same sense as the integer-charge calculation; only non-zero masses occur in the logarithms. The finite result implies a liberation of quark quantum numbers, suggesting that confinement cannot be a consequence of the Yang-Mills perturbation theory, but must arise from additional (non-perturbative) mechanisms.

58455 **(IC—79/6) Heavy quark and magnetic moment.** Mubarak, A.; Jallu, M.S. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702015.

The magnetic moments and transition moments of heavy hadrons including the conventional particles are obtained under the SU(5) truth symmetry scheme. To this end state vectors are defined and the quark additivity principle is taken into account.

58456 **(IC—79/7) Dynamical quark mass and the U(1) problem.** Kawarabayashi, K.; Suzuki, T. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702016.

Consistency of Ward identities associated with the U(1) problem is re-analyzed in the WKB approximation. It is argued that when SU(N) x SU(N) is spontaneously broken, a flavour singlet zero-mass boson coupled to the gauge-invariant U(1) current appears in the physical sector, invalidating the usual "solution of the U(1) problem". A possible way to resolve the problem is then discussed.

58457 **(IC—79/8) Flavour and spin structure of linear baryons.** Kawarabayashi, K.; Kitakado, S.; Inami, T. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702017.

Based on the string picture, a phenomenological model for baryons is constructed and their flavour symmetry, exchange degeneracy pattern and spin structure are studied. Baryons on leading trajectories are assumed to have the configuration of two quarks being attached to the ends of a linear string and the third sitting in the middle, called linear baryons. For such linear baryons, a unitarization scheme can be constructed in a manner similar to the dual unitarity scheme for mesons but without recourse to the 1/N expansion. It is found that the interchange interaction of the middle quark with one of the other two quarks at the ends of the string can give rise to a large exchange degeneracy breaking of baryon spectrum. With this non-planar correction, the model of linear baryons can account for the observed pattern of leading baryon states.

58458 **(IFVE-ONF—81-144) Quasielastic neutrino scattering νsub(μ)+n→μsup(-)+p at 2-20 GeV in bubble chamber SCAT.** Makeev, V.V.; Myagkov, A.G.; Polyarush, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 8p. NTIS (US Sales Only), PC A02/MF A01.

The total cross sections σ and the dN/dq^2 (q^2 - four momentum transfer squared) differential distributions of the νsub(μ)n → μ^-p quasi-elastic scattering have been measured. The experiments were carried out at the SCAT bubble chamber filled with CF_3Br. The σ as a function of neutrino energy and the dN/dq^2 as a function of q^2 are presented. The data were analyzed in terms of the V-A theory of weak interactions. As a result the values of the total hadronic mass Msub(A) were found as 0.90+-0.008 GeV (from the energy dependence) and 0.86+-0.18 GeV (from the dN/dq^2 distribution).

58459 **(IFVE-OTF—80-173) Elastic scattering model of hadrons with large momentum transfers.** Goloviznin, V.V.; Shigirev, A.M.; Solov'ev, L.D.; Shchelkachev, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1980. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702521.

The quark parton model (QPM) for deep inelastic lepton-hadron scattering is generalized in order to describe elastic hadron scattering at large momentum transfer. A QPM generalization corresponding to coherent composition of parton subprocess amplitudes is considered. The effects of multiple parton rescattering in the investigated process are assumed negligible. A simple quark-parton model for description of elastic hadron-hadron (hh)-scattering in large momentum transfer ranges is obtained. Ele--ctromagnetic pion and nucleon form factors and differential cross sections for pp-scattering are compared with experiments. The simple mechanism for polarization effects is considered and then the qualitative explanation for sharp growth of the spin-spin correlation parameter Asub(nn) near 90 deg is given.

58460 **(IFVE-OTF—81-28) Possibility of dynamical arising of fermion mass in QCD.** Alekseev, A.I.; Arbuzov, B.A.; Bajkov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

In the framework of QCD the Schwinger-Dyson equation for fermion propagator is considered in the infrared region. Under assumption of power infrared asymptotics of gluon propagator in two different gauges axial and covariant, the solution of the equation can exist for particular values of fermion mass. In this the infrared asymptotics of gluon propagator is to be $1/(k^2)^2$ in the gauges under consideration. Possible interpretation of the results is discussed in application to the problem of dynamical quark mass generation.

58461 **(IFVE-OTF—81-75) Scattering at fixed angles with account for exchange interaction.** Kostenko, O.F.; Troshin, S.M.; Tyurin, N.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

In the framework of single-time equation for the scattering amplitude (relativistic equation of quantum theory of damping) angular dependence of the cross section has been calculated. The results are compared with the existing data for πN scattering. The geometrical picture for the scattering at angles close to 0 deg and 180 deg and essential role of the forward and backward interaction radii are being discussed.

58462 **(IFVE-OTF—81-79) Scaling violation in the heavy quark fragmentation functian.** Avaliani, I.S.; Kartvelishvili, V.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The scaling violation in the heavy quark fragmentation functions is analysed in the framework of the leading logarithmic approximation in QCD and it is shown, that the slaling violation effects are more essential for heavy quarks, than for light ones. These results indicate that the D-meson inclusive spectra measurement is a sensitive test for some standard assumptions.

58463 **(IFVE-OTF—81-96) Quark-parton model and charge-exchange reaction at large momentum transfer.** Solov'ev, L.D.; Shchelkachev, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702704.

A good description for exclusive π^-p charge-exchange reactions at -t>=3 (GeV/c)^2 and psub(lab.)>25 (GeV/c) is received by means of the simple quark parton model. This model permits to use the information from inclusive reactions and deep inelastic eh-scattering in order to describe the exclusive hadron reactions. Some predictions for charge exchange cross sections at large momentum transfer are received. The comparison of the model with the experiment gives the possibility to determine the quark structure functions for π^0 and eta mesons.

58464 **(IFVE-OTF—81-99) Doublet composite schemes of leptons and quarks.** Pirogov, Yu.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702522.

All simplest doublet composite schemes are classified. Four different doublet schemes are shown to be available. A new scheme with charge doublet Q=(2/3, -1/3) rather advantageous as compared with the previous ones is being considered. Some difficulties in interpreting the colour as an effective symmetry are pointed out.

58465 **(IFVE-OTF—81-103) Invariant current algebra on the light cone and deep inelastic lepton-hadron scattering. Part 1.** Lunev, F.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

Invariant current algebra on the light cone is formulated. Commutation relations of electromagnetic hadron currents are obtained. Cross section constraints for deep inelastic electron-hadron scattering are considered.

58466 **(IFVE-OTF—81-116) Mean associative multiplicities in deep inelastic processes.** Dzhaparidze, G.Sh.; Kiselev, A.V.; Petrov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702018.

The associative hadron multiplicities in deep inelastic and Drell--Yan processes are studied. In particular the mean multiplicities in different hard processes in QCD are found to be determined by the mean multiplicity in parton jet.

58467 **(IFVE-OTF—81-143) ν/sub (μ)/N$\to\mu^-$Nπ reactions in the hard pion model.** Bel'kov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The νsub(μ)N$\to\mu$sup(-)Nπ reaction has been considered in the phenomenological chiral Lagrangian approach in the hard pion model. The absence of other isobars in the νsub(μ)p$\to\mu$sup(-)pπsup(+) channel but Δ_{33} isobar allows one to carry out analysis of this process in the framework of the model. Numerical estimations of contributions of various diagrams in total cross sections of νsub(μ)N$\to\mu$sup(-)Nπ reactions from the threshold to the 1.5 GeV energy are given. The analysis of the data of the reactions νsub(μ)N$\to\mu$sup(-)Nπ as well as the check of the theory of broken chiral symmetry may provide useful informations about π^-, rho- and A_1 meson interaction with low-lying baryon resonances.

58468 **(IFVE-OTF—81-157) Average multiplicities in hard processes.** Dzhaparidze, G.Sh.; Kiselev, A.V.; Petrov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01.

Hadron production in deep inelastic lepton-hadron scattering is investigated. Multiplicities have been considered in various hard processes. The multiplicity in a parton jet defines these above in a universal way. Particularly an asymptotic equality is obtained for an average number of target and current fragmentation products in deep inelastic scattering.

58469 **(INIS-mf—7099) Electric quadrupole moments and strong interaction effects in pionic atoms of ^{165}Ho, ^{175}Lu, ^{176}Lu, ^{179}Hf and ^{181}Ta.** Olaniyi, B.; Shor, A.; Cheng, S.C.; Dugan, G.; Wu, C.S. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). May 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780696.

The effective quadrupole moments Q sub(eff) of the nuclei of ^{165}Ho, ^{175}Lu, ^{176}Lu, ^{179}Hf and ^{181}Ta were accurately measured by detecting the pionic atom 5g-4f x-rays of the elements. The spectroscopic quadrupole moments, Q sub(spec), were obtained by correcting Q sub(eff) for nuclear finite size effect, distortion of the pion wave function by the pion-nucleus strong interaction, and contribution to the energy level splittings by the strong interaction. The intrinsic quadrupole moments, Q_0, were obtained by projecting Q sub(spec) into the frame of reference fixed on the nucleus. The shift, epsilon$_0$, and broadening, GAMMA$_0$, of the 4f energy level due to the strong interactions between the pion and the nucleons for all the elements were also measured. Theoretical values of epsilon$_0$ and GAMMA$_0$ were calculated and compared to the experimental values. The measured values of Q_0 were compared with the existing results in muonic and pionic atoms. The measured values of epsilon$_0$ and GAMMA$_0$ were also compared with existing values.

58470 (INIS-mf—7116, pp vp) **Nonleptonic decays of charmed mesons.** Gorman, R.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58471 (INIS-mf—7116, pp vp) **Quark properties in a dynamical preon model.** Williams, P.C. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58472 (INIS-mf—7116, pp vp) **Nucleon-antinucleon annihilation into di-meson final states.** Darling, T.; Tovey, S.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58473 (INIS-mf—7116, pp vp) **Invariant connections and magnetic monopoles.** Cant, A. (Australian National Univ., Canberra. Dept. of Theoretical Physics:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58474 (INIS-mf—7116, pp vp) **Neutrino oscillations - a review.** Peak, L.S. (Sydney Univ. (Australia)). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58475 (INIS-mf—7116, pp vp) **Neutrino oscillations and ν-e and anti-ν-e scattering.** Halls, B.M.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58476 (INIS-mf—7116, pp vp) **Effective density dependent interaction derived from the Paris potential.** Von Geramb, H.V. (Hamburg Univ. (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58477 (INIS-mf—7116, pp vp) **Dibaryon resonances.** Afnan, I.R. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58478 (INIS-mf—7116, pp vp) **Anti-proton annihilations in deuterium.** Parkin, S. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58479 (INIS-mf—7116, pp vp) **Extending the coupled NN-πNN equation.** Stelbovics, A.T.; Afnan, I.R. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58480 (INIS-mf—7116, pp vp) **Current status of the standard model of particle physics.** Wignall, J.W.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58481 (INIS-mf—7116, pp vp) **Quarks and diquarks in a baryon string model.** Burden, C.J. (Australian National Univ., Canberra. Dept. of Theoretical Physics:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58482 (INIS-mf—7116, pp vp) **Effective field theory with application to weak non-leptonic interactions.** Miller, R.D.C.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58483 (INIS-mf—7116, pp vp) **Hyperon physics.** Tovey, S.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58484 **(INP—1109/PH) Projectile fragmentation in hadron-nucleus collisions at high energies.** Bialas, A.; Czyz, W. (Institute of Nuclear Physics, Krakow (Poland)). 1980. 39p. NTIS (US Sales Only), PC A03/MF A01.

Particle production in hadron-nucleus collisions at high energies is discussed in the projectile fragmentation region. The predictions of the constituent quark model and of the multiple scattering models are analyzed and compared. The contribution of diffractive interactions is explicitely taken into account. Comparison with the recent Fermilab measurements shows good agreement with the quark model and strong effects of diffractive collisions in some of the analyzed reactions.

58485 **(ITEF—77(1981)) Introduction to quantum chromodynamics. Deep inelastic scattering of leptons on nucleons.** Voloshin, M.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 62p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702019.

In the framework of lectures on quantum chromodynamics deep inelastic scattering of leptons on nucleons is considered. To describe the deep inelastic scattering a formal approach of field theory is applied. In the framework of a parton model the process of lepton pair production is investigated. The cross section of the process is determined. At great values of four momentum transfer to hadrons by leptons the difference from the parton model have been observed, which are explained by quantum chromodynamics. These differences logarithmically depend on the q value.

58486 **(ITEP—78(1980)) Hadronic mass-relations from topological expansion and string model.** Kaidalov, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 16p. NTIS (US Sales Only), PC A02/MF A01.

Hadronic mass-relations from topological expansion and string model are derived. For this purpose the space- time picture of hadron interactions at high energies corresponding to planar diagrams of topological expansion is considered. Simple relations between intercepts and slopes of Regge trajectories based on the topological expansion and q anti q-string picture of hadrons are obtained.

58487 **(ITEP—79(1980)) Electromagnetic form-factors of hadrons at large Q^2 and effects of confinement.** Kaidalov, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 8p. NTIS (US Sales Only), PC A02/MF A01.

The importance of the nonperturbative effects for the behaviour of electromagnetic form factors of hadrons at large Q^2 is emphasized. In the framework of the topological expansion and the colour tube model it is demonstrated, that the dependence of form factors on Q^2 is determined by the intercepts of Regge-trajectories. The perturbation theory is used in order to take into account the effects connected to the hard gluon emission. Good description of the magnetic form-factor of nucleon is obtained.

58488 **(ITEP—89(1981)) SU(3)-mixing of the S-wave dibaryon resonance.** Badalyan, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702316.

The Gell-Mann-Okubo mass formula is used to predict unambiguously $^1S_0$ resonances in the $\Sigma\Sigma$ channels (I=2) near $\Sigma\Sigma$ threshold. It is shown that the linear mass formula is compatible with the existence of the $^1S_0$ threshold resonances in many dibaryon systems which enter the 27 representation. The $^3S_1$ threshold resonances, $p\Lambda$ (M approximately equal to 2054 MeV) and $N\Sigma$ (I=1/2, M=2129 MeV), are considered as members of 8a and 10^* with the mixing angle THETA determined by the mass of the $\Sigma^+ \Xi^0$ resonance ($^3S_1$, I=3/2).

58489 (ITEP—96(1981)) Mechanisms of forward-backward spectator asymmetry in low-energy anti pD annihilation. Kondratyuk, L.A.; Shmatikov, M.Zh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702317.

The mechanisms producing the forward-backward asymmetry of the proton-spectator in the low-energy anti pD annihilation are considered. The single mechanism which could give the experimentally observed asymmetry is the real part of the anti pp elastic scattering amplitude. Existing experimental data on the asymmetry can be described assuming the existence of a D-wave anti pp resonance with the mass approximately equal to 1980 MeV.

58490 (ITF—80-122P) Problem of three strongly interacting particles, two of which are charged. Kharchenko, V.F.; Shadchin, S.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1980. 32p. (In Russian). Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR.

The integral equations for the system of three particles, two of which are charged, are reformulated - separating out explicitly from the kernel all the singularities that arise due to the presence of the long-range Coulomb pair interaction. The kernel of the regularized set of equations (Faddeev-Noble's type equations) is determined by the solution of an auxiliary problem. The developed formalism allows one to define the finite nuclear-Coulomb scattering length of a particle by two other particles in a bound state. The equations obtained are valid at all energies of the three-particle system.

58491 (JINR—E-2-81-251) Dynamics of colour in hadron-diffraction on nuclei. Kopeliovich, B.Z.; Lapidus, L.I.; Zamolodchikov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 4p. NTIS (US Sales Only), PC A02/MF A01.

Hadron-nucleus elastic and inelastic diffraction scattering is treated by means of the eigenstate method, in which all the inelastic shadowing corrections can be effectively summed up. The hadron-nucleon scattering amplitude is calculated in the Born approximation to the QCD. It is shown that a statement about abnormality small absorption of diffractive dissociation products inside the nucleus is a result of ignoring the inelastic shadowing.

58492 (JINR—E-2-81-486) Lowest order electroweak corrections to spin 1/2 fermion scattering. 2. The one-loop amplitudes. Bardin, D.Yu.; Christova, P.Ch.; Fedorenko, O.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702239.

A calculation of the one-loop electroweak corrections to scattering of spin 1/2 fermions within the Weinberg-Salam like theory started elsewhere is continued. A renormalization scheme, based on a natural choice of input parameters, i.e., electron charge e and masses of all particles (Msub(W), Msub(Z), Msub(chi) and fermion masses msub(f)), is considered in detail. This scheme is generalized for the theory with an arbitrary unitary mixing of fermion fields.

58493 (JINR—E-2-81-548) Proton structure functions at large transfer momenta and its description in a model with the quark-amplitude factorizability assumption. Linkevich, A.D.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702705.

The shape of structure functions of deep inelastic scattering of electrons on nucleons is found. To this end the dynamical model of factorizing quark amplitudes is used. It is shown that the BCDMS experimental (NA-4) data at Q^2 approximately 30-170 GeV^2 and the data of the earlier SLAC experiment at a $Q^2 <= 20$ GeV^2 are well described by the dynamical model of factorizing quarks (DMFQ).

58494 (JINR—R-2-81-217) Eta → 3π and eta → $\pi^0 \gamma\gamma$ decays in chiral theory. Volkov, M.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702020.

The widths of the eta → $3\pi^0$ and eta → $\pi^0\gamma\gamma$ decays are evaluated to a higher-than-ever degree of accuracy in the chiral model corresponding to the U(3)xU(3) group. The mass matrix with three arbitrary parameters corresponding to the masses of u, d and s quarks is used. The mixing angle is also asumed to differ from zero, and evaluations have been made at its two possible values: -10 deg and -18 deg. For the eta → $3\pi^0$ decay the following GITA values are obtained: GITA(-18 deg) = 0.28 keV; GITA(-10 deg) = 0.22 keV. For the eta → $\pi^+\pi^-\pi^0$ decay: GITA(-18 deg) = 0.17 keV, GITA(-10 deg) = 0.14 keV. The values are well consistent with available experimental data. For the eta → $\pi^0\gamma\gamma$ decay: GITA(-18 deg) = $1.6\text{x}10^{-3}$ eV, GITA(-10 deg) = $1.3\text{x}10^{-3}$ eV. The values are substantially less than the rough theoretical evaluations available and differ by four order of magnitude from old experimental data. However, the latest measurements performed at the Institute of high energy physics (Serpuchov), do not contradict the values.

58495 (JINR—R-2-81-369) Minimized economical interactions. Ghiordanescu, N.; Stavinskij, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The idea of economical interaction is suggested according to which inclusive particle production in extremal situations is determined by minimum possible total energy of colliding constituents. Experimental data on cumulative production cross sections of pions and kaons depending on minimum possible interacting constituents energy are given. It is shown that inclusive reactions of various types, cumulative processes at large orders of cumulativity and processes with large transverse momenta are described by an unit universal function of minimum possible total energy of colliding constituents, minimized masses of which are determined by kinematics of inclusive particle production.

58496 (JINR—R-2-81-481) Meson structure functions and covariant wave functions of quark bound states. Kapshaj, V.N.; Linkevich, A.D.; Savrin, V.I.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The problem of describing deep inelastic scattering of leptons on pseudoscalar meson is discussed. A meson is considered as a bound state of scalar quark and antiquark of the same mase which interact by means of scalar gluon exchange. Formulae of the structure functions of composite two-particle systems through relativistics single-time wave functions of the constituent relative motion are obtained. A new scaling variable is introduced. It is found that an exact solution of the equation for the wave function with the interaction kernel taken in the form of the one-gluon exchange amplitude leads to a power violation of scaling.

58497 (JINR—R-2-81-552) Radiative corrections to the $\nu N \rightarrow \nu X$ process. Bardin, D.Yu.; Dokuchaeva, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702523.

Within the framework of the Weinberg-Salam theory and the quark-parton model of strong interaction radiative corrections to deep inelastic muonless neutrino scattering $\nu N \rightarrow \nu X$ are estimated. It is shown that making allowance of radiative corrections at data analysis for Rsub(ν(anti ν)) = σsub(ν(anti ν))sup(NC)/σsub(ν(anti ν))sup(CC) could result in decreasing sinsup(2)thetasub(w) parameter by approximately 5%.

58498 (JINR—R-2-81-553) **Simulation of baryon like quark bound states with $V(r)=-g^2r^{-1}(1-a^2r^2)$.** Bogolyubskij, I.L.; Bogolyubskaya, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702706.

Baryon like bound states of large number of quarks having the same "flavour" and different "colours" are investigated in the Hartree-Fock approximation, when pair attractive potential is $V(r)=-g^2r^{-1}$ $(-a^2r^2)$. All the quarks are assumed to be in the same spin state. The coordinate part of wave function is assumed to have the samplest factorized form. An arising integrodifferential eigenvalue problem is solved by transformation to sixth order nonlinear differential equation. By means of computer localized solutions of this equation are investigated and among them solutions of considered eigenvalue problem corresponding to the ground and excited bound states are picked out. The results are compared with the analogous ones obtained by the authors previously for the cases of purely Coulomb and linear attractive potentials.

58499 (JINR—R-2-81-557) **Approximate solution of QCD evolution equations with radiative corrections.** Bednyakov, V.A.; Zlatev, I.S.; Isaev, P.S.; Kovalenko, S.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702707.

The QCD equations in the second-order approximation on the $g^2(Q^2)$ effective coupling constant of strong interaction which descri Q^2-evolution of nucleon quark and gluon distribution functions are solved approximately. The initial conditions for this equations cannot be evaluated in the QCD perturbation theory. It is calculated using phenomenological quark-gluon model of nucleon structure. The distribution functions are found in an explicit analytical form. The comparison with experimental data is carried out.

58500 (JINR—R-2-81-729) **Unified model of multiple production of hadrons in various processes at high energies.** Kalinkin, B.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702021.

A mechanism is proposed for the dynamic confinement of colour. On its basis a statistical model is constructed for the multiple production of hadrons at high energies. It well describes the main characteristics of this process in hadron interactions, e^+e^- annihilation, deep inelastic lepton-nucleon scattering, and in reactions with the production of particles with large transverse momenta. This model does not contradict the data on multiple production at superhigh energies.

58501 (KEK—80-14, pp 43-47) **Study of proton-proton and deuteron-proton interactions by a bubble chamber.** Shimizu, F.; Katayama, N.; Sai, F. (Tokyo Univ. (Japan)). Feb 1981. (In Japanese). NTIS (US Sales Only), PC A07/MF A01.

From Workshop on high energy nuclear studies at KEK; Oho, Ibaraki, Japan (16 Dec 1980).

A preliminary report on the analysis of bubble chamber data at the energy of 1.35 and 1.55 GeV/c is described. The purpose of this study is to investigate the behavior of π production cross section in p-p interaction. The total elastic cross sections are 25.0 mb at 1.35 GeV/c and 25.5 mb at 1.55 GeV/c. The cross-sections of π-production such as $pp\text{-}pn\pi^+$ and $pp\text{-}pp\pi^0$ were directly obtained. The values were 11.9 mb for $pn\pi^+$ and 3.5 mb for $pp\pi^0$ at 1.35 GeV/c, and 17.3 mb for $pn\pi^+$ and 4.7 mb for $pp\pi^0$ at 1.55 GeV/c. The values of $pp\pi^0$ did not agree with previously reported data at high energy. In the production of $(\text{delta})^{2+}$ in the $pp\text{-}pn\pi^+$ reaction, Monte Carlo calculation explains well this mass distribution. A preliminary experiment of dp reaction was done at the deuteron energy of 2 GeV/c. The tagging of spectator will be done.

58502 (KMU-HEP—81-01) **Monte-Carlo-code BAMJET to stimulate the fragmentation of quark-antiquark jets.** Ritter, S. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jan 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702022.

A computer code BAMJET (Baryon-Meson JET) in Fortran language is described. The code BAMJET simulates the fragmentation into hadrons of quark-antiquark systems produced in positron-electron-annihilation processes on the basis of a chain decay model. The programme treats also the fragmentation of charmed quarks. In detail all subroutines are described, the most important input and output variables and fields are listed. Besides the flow diagramm of the code BAMJET the results of the simulation are tabulated.

58503 (KMU-HEP—81-05) **Gauge vector boson pair production at antipp collider energies.** Hellmund, M.; Ranft, G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Aug 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702023.

Within the standard SU(2)xU(1) model differential cross sections and angular distributions of all polarization states are studied for all channels of gauge vector boson pairs accessible in hadron hadron collisions, W^+W^-, Z^0Z^0, $Z\gamma$, ZW, γW. The zero in the unpolarized angular distribution of qantiq → $W\gamma$ is confirmed. The origin of this Mikaelian zero is studied. None of the other channels exhibits a zero in the unpolarized angular distribution, but strong minima at cos theta = 0 are predicted for qsub(i)antiqsub(j) → $Z\gamma$ and qsub(i)antiqsub(j) → ZW^+. These are of different origin than the Mikaelian zero. Simple structure functions suggest that these minima are seen in pantip collisions.

58504 (KMU-HEP—81-06) **Production of polarized baryons in polarized and unpolarized e^+e^- collisions.** Ranft, J.; Ranft, G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Sep 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702024.

Polarized and unpolarized e^+e^- annihilation is considered in lowest order at energies 30 to 150 GeV taking γ and Z^0 exchange in the standard SU(2)xU(1) model into account. The fragmentation of polarized quarks into polarized baryons is described by two kinds of fragmentation functions; the first is based on SU(6) weights and empirical expressions for favoured and disfavoured fragmentation; the second is based upon a Monte Carlo model of the chain decay including helicities of quarks and hadrons. From the cross sections for e^+e^- → qantiq and the fragmentation functions we obtain predictions for the baryon polarization as function of the collision energy and of kinematical variables.

58505 (LPC—81-22) **Eikonal corrections to hard processes.** Bordes, G.; Nicolaidis, A. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702026.

We consider within Quantum Chromodynamics those semi-inclusive hard processes where two large mass scales appear. Summation of single and double logarithms arising from soft gluonic emission introduces eikonal form factors. We obtain a satisfactory agreement with recent experimental data on transverse momentum distribution of lepton pairs and acoplanarity distributions of hadrons at large transverse momenta.

58506 (NASA-TM—82450) **Adaptation of the TH epsilon mu formalism for the analysis of the equivalence principle in the presence of the weak and electroweak interaction.** Fennelly, A.J. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Oct 1981. 40p. NTIS, PC A03/MF A01.

The TH epsilon mu formalism, used in analyzing equivalence principle experiments of metric and nonmetric gravity theories, is adapted to the description of the electroweak interaction using the Weinberg-Salam unified SU(2) x U(1) model. The use of the TH epsilon mu formalism is thereby extended to the weak interactions, showing how the gravitational field affects W sub mu (+ or -1) and Z sub mu (0) boson propagation and the rates of interactions mediated by them. The possibility of a similar extension to the strong interactions via SU(5) grand unified theories is briefly discussed. Also, using the effects of the potentials on the baryon and lepton wave functions, the effects of gravity on transition mediated in high-A atoms which are electromagnetically forbidden. Three possible experiments to test the equivalence principle in the presence of the weak interactions, which are technologically feasible, are then briefly outline: (1) K-capture by the FE nucleus (counting the emitted X-ray) (2) forbidden absorption transitions in high-A atoms' vapor and (3) counting the relative Beta-decay rates in a suitable alpha-beta decay chain, assuming the strong interactions obey the equivalence principle.

58507 (NBI-HE—81-50) Relevance of the 3q-annihilation and the radiative proton decay. Eeg, J.O.; Picek, I. (Niels Bohr Inst., Copenhagen (Denmark)). Dec 1981. 12p. NTIS (US Sales Only), PC A02/MF A01.

The branching ratio R = GAMMA($p \rightarrow e^+ \gamma$)/GAMMA($p \rightarrow e^+ \pi^0$) is calculated in the SU(5) model of grand unification within a pole model approach. The result is an upper limit R <approximately 10^{-3} and consequently the $p \rightarrow e^+ \gamma$ decay mode is not found to occur at an observable rate in experiments of the near future.

58508 (NBI-HE—82-4) Trial for analytic calculation of meson spectrum in SU(3) lattice QCD. Kawamoto, N.; Shigemoto, K. (Niels Bohr Inst., Copenhagen (Denmark)). Mar 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702708.

The low-lying meson spectrum including u, d, s and c quarks is studied by a random walk technique combined with strong coupling - mean field approximation. Hopping parameters as a function of the coupling constant are determined and compared with Monte Carlo results. The quark masses are also estimated.

58509 (NBI-HE—82-9) Redei-like model and testing Lorentz invariance. Nielsen, H.B.; Picek, I. (Niels Bohr Inst., Copenhagen (Denmark)). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702709.

The authors present an argument in support of a very simple and predictive model for noncovariant laws of nature. Provided the deviation from Lorentz invariance is still rotational invariant, a very predictive one parameter model is left. It results in the Redei-like behaviour of particle lifetimes, and selection rules are obtained which determine the most promising weak-decay experiment tests of Lorentz invariance. In this respect more accurate measurements of dominant charged pion and kaon decay modes are strongly encouraged.

58510 (PB—82-178468) On the transverse momentum distribution of quarks created in a flux tube. Bowler, M.G. (Oxford Univ. (UK). Nuclear Physics Lab.). 1981. 14p. NTIS, PC A02/MF A01.

In the Monte Carlo generation of mesons in jets initiated by quarts or gluons, the transverse momentum distribution of created quarks is usually chosen to be gaussian. The interpretation of the high meson transverse momentum tail, planar and three jet events in e(+)e(-) annihilation in terms of hard gluon bremmstrahlung is both qualitatively and quantitatively sensitive to this assumed distribution. In this note, the author estimates the transverse momentum distributions obtained when quarks are created in pairs within a flux tube, and concludes that the gaussian distribution is probably an entirely adequate representation.

58511 (PM—81/5) Threshold enhancements and resonant effects in exclusive $\gamma\gamma$ reactions. Layssac, J.; Renard, F.M. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). May 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82903362.

In connection with the rho rho enhancement recently observed at 1.6 GeV we estimate and discuss contributions of threshold effects and resonances to the cross-sections of several exclusive channels like $\gamma\gamma \rightarrow VV''$, $V\gamma$, eta $\pi\pi$, KK^* and πA_1.

58512 (RL—81-086) Hyperfine splittings of bag model gluonia. Barnes, T.; Close, F.E.; Monaghan, S. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Nov 1981. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702027.

Order αsub(s) contributions to the energy shifts in gluonia are studied in the MIT bag model. The naive result that $M(0^{-+}) > M(0^{++})$ is preserved for αsub(s) <approximately 3, although $M(0^{-+}) < M(2^{++})$ results for αsub(s) >approximately 0.54. The 0^{-+} and 2^{++} can thus be identified with i(1440) and theta(1640) for reasonable values of αsub(s) and bag size, in which case the 0^{++} mass is predicted to be approximately 1.0 Gev.

58513 (RL—81-090) MIT bag can accommodate the theta (1640) and i(1440) as glueballs. Barnes, T.; Close, F.E.; Monaghan, S. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Nov 1981. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702029.

QCD perturbation effects at O(αsub(s)) are studied for gluonia in the MIT bag. If αsub(s) > 0.54 then the 2^{++} is heavier than the O^{-+} in line with the theta(1640) and i(1440) states. The observed splitting and absolute magnitudes are consistent with a bag radius approximately equal to 1 fm. A scalar glueball is predicted at 1 GeV and may mix with S^* (980).

58514 (UM-P—81/42) Hybrid model for charmed meson decays. Gorman, R.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1981. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702030.

It is shown that a hybrid model, combining the pole model and the c quark decay model, provides a reasonable description of the relative branching ratios and absolute decay rates for two body decays of charmed mesons.

58515 (UM-P—81/43) Electromagnetic decay widths for L=1, Jsup(PC)=1^{--} T-baryonia: II. Ellis, R.G.; McKellar, B.H.J.; Joshi, G.C. (Melbourne Univ., Parkville (Australia). School of Physics). 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702031.

The electromagnetic decay widths of the Jsup(PC)=1^{--}, L=1 T-baryonia in the 1-5 GeV region are estimated. The Van Royen-Weisskopf technique is extended to baryonia within the framework of the QCD potential model. The diquark and antidiquark are assumed to have finite extent. Potential dependent coefficients are scaled from known baryon and mesons.

58516 (UM-P—81/50) Phase consistency and dissociated wavefunctions of Q^4 anti Q baryons. Bickerstaff, R.P. (Melbourne Univ., Parkville (Australia). School of Physics). 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702032.

It is demonstrated, using simple, algebraic techniques, that Strottman's dissociation of the Q^4-anti Q bag-model wavefunctions into ordinary baryon-meson coupled wavefunctions has not been done in a phase consistent manner.

58517 (WIS-Ph—82/1) Are quarks and leptons composite. Harari, H. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Jan 1982. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702524.

The possibility that quarks and leptons are composite was studied. A line of reasoning was pursued which followed several steps. The standard model was assumed and the need to go beyond it was demonstrated. Different classes of ideas were considered. The notion of compositeness and its general difficulties, mainly the scale problem, were studied. A connection between composite massless fermions and an unbroken chiral symmetry was assumed. A general framework based on hypercolor and a chiral symmetry was established. The general requirements for a candidate model were established. A minimal scheme was found and its successes and failures were studied.

58518 Coupled-channel interaction for intermediate-energy nucleon-nucleon reactions. Lomon, E.L. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] D: Particles and Fields;* 26: No. 3, 576-601(1 Aug 1982). Contract AC02-76ER03069.

General effects of coupling a system to higher-mass channels are reviewed. The dominant effect is the addition of an attraction which increases with energy up to and, when the coupled channel is not in an S state, beyond inelastic threshold. This can produce resonances whose widths and inelasticities are largely determined by the resonance position. A model is presented for nucleon-nucleon channels coupled to NΔ, NN*, or ΔΔ channels. It uses the Feshbach-Lomon nucleon-nucleon interaction and one-pion-exchange potentials plus phenomenological cores for the transition interactions. The width of the isobars is included. Good fits are obtained to NN channels for E/sub L/< or ≈1 GeV, including the "resonant" $^1D_2$ and $^3F_3$ partial waves. A structure may be present in the $^3P_0$ partial wave. In those partial waves where one-pion exchange predicts the largest transition potentials, the fit is improved by the long-range potential tails.

58519 Isospin relations by counting. Wohl, C.G. (Lawrence Berkeley Laboratory, Berkeley, California 94720). *American Journal of Physics;* **50**: No. 8, 748-753(Aug 1982). Contract W-7405-ENG-48.

A method is given for finding the relations between reaction cross sections or decay branching fractions that result from isospin conservation. The method was discovered long ago by Shmushkevich but is not widely known. It makes no call on the usual machinery of amplitude expansions and Clebsch—Gordan coefficients, but works instead by apportioning certain populations of particles according to a simple counting rule, the charge-uniformity rule. A number of examples, including several that require lengthy calculation to solve using Clebsch—Gordan coefficients, are here solved by inspection, usually without any equations at all.

58520 Twist-4 effects in electroproduction: Canonical operators and coefficient functions. Jaffe, R.L.; Soldate, M. (Center for Theoretical Physics Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 49-68(1 Jul 1982). Contract AC02-76ER03069.

The interpretation of observed scaling violations in leptoproduction is complicated by the possible presence of significant higher-twist effects. We refine the machinery of the operator-product expansion sufficiently for a study of twist-4 effects. In particular, we introduce and review the advantages of a special, "canonical" basis. We demonstrate that the canonical basis is adequate for the necessary twist-4 perturbative calculations, and calculate the operator's tree-level coefficient functions in electroproduction. Our results establish a framework within which careful analysis of more accurate data can provide information regarding correlations among the constituents of the proton.

58521 Quantum-chromodynamic predictions for direct photons in e^+e^- collisions. II. Analysis of the third and fourth structure functions W-bar$_3$/sup γ/ and W-bar$_4$/sup γ/. Sasaki, K. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510 and Department of Physics, Faculty of Education, Yokohama National University, Yokohama 240, Japan). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 69-81(1 Jul 1982).

We analyze in quantum chromodynamics the timelike photon structure functions W-bar$_3$/sup γ/ and W-bar$_4$/sup γ/ which appear in the direct photon production in e^+e^- collisions, using the cut-vertex formalism and the renormalization-group method. It is found that W-bar$_3$/sup γ/ in leading order is not renormalized by the strong interactions and agrees with the result calculated in the simple parton model. The moments of W-bar$_4$/sup γ/ are calculated in the leading order. Then, the structure function is obtained by inverting the moments. The corrections to W-bar$_4$/sup γ/ by strong interactions are found to be large at small and large z.

58522 Analysis of the J/sup P/ = 1^+ three-pion system using a generalized Watson theorem for production of multiquark states. Longacre, R.S. (Brookhaven National Laboratory, Upton, New York 11976). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 82-90(1 Jul 1982). Contract AC02-76CH00016.

We analyze the J/sup P/ = 1^+ three-pion production amplitudes obtained from the most recent diffractive, charge-exchange, and backward-production experiments. We have found effects in the amplitudes that we interpret in terms of qq-bar, q^2q-bar^2, and q^3q-bar^3 interactions. The qq-bar piece gives rise to the A_1 resonance whose parameters are M/sub A/$_1$ = 1230 +- 30 MeV and Γ/sub A/$_1$ = 330 +- 60 MeV, whereas the backward-production reaction shows a strong qq-bar and q^2q-bar^2 interference effect. The επ scattering couples only to the q^2q-bar^2 and q^3q-bar^3, and thus argues in favor of Jaffe's four-quark model of the ε.

58523 Quantum-chromodynamic jet masses in hadronic collisions. Clavelli, L. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 91-99(1 Jul 1982). Contract W-31-109-ENG-38.

In analogy to e^+e^- annihilation, we discuss the QCD predictions for the broadening of the forward-backward jets in hadronic collisions, in terms of the expectations for the corresponding invariant-mass spectra.

58524 High-twist production of prompt single photons at large transverse momentum. Berger, E.L. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 105-113(1 Jul 1982).

Quantitative predictions are presented for a specific hard-scattering reaction $\pi N \rightarrow \gamma X$ in which both the incident meson and the produced prompt photon couple directly in the QCD amplitude. The process leads to a highly constrained class of events at large p/sub T/ in which the photon momentum is balanced by that of a recoil quark jet, with no spectator jet of final-state particles emerging along the beam axis. Normalized absolutely in terms of the electromagnetic form factor of the pion, F/sub π/(Q^2), the cross section provides a lower bound on the total p/sub T/ $^{-6}$ high-twist contribution to the inclusive prompt photon yield.

58525 Predictions of left-right-symmetric grand unified theories. Caswell, W.E.; Milutinovic, J.; Senjanovic, G. (University of Maryland, College Park, Maryland 20742). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 161-174(1 Jul 1982).

We present an analysis of renormalization effects for a class of grand unified theories which contain SU(2)/sub L/ x SU(2)/sub R/ x U(1) /sub B/-L left-right-symmetric low-energy electroweak model. Previously obtained predictions for the proton lifetime are improved at the two-loop level and we find 10^{32}< or =tau/sub p/ < or =10^{39} yr for 50< or =Λ/sub M/S< or =400 MeV (MS indicates the modified minimal-subtraction scheme). In addition, we calculate the quark-lepton mass ratios and the enhancement factors for all the leading baryon-number-violating operators. Implications of our results for the selection rules in baryon decay are also presented.

58526 Decays of weak vector bosons and t quarks into doubly charged Higgs scalars. Barger, V.; Baer, H.; Keung, W.Y.; Phillips, R.J.N. (Department of Physics and Astronomy, University of Hawaii at Manoa, Honolulu, Hawaii 96822). *Physical Review* [*Section*] *D: Particles and Fields;* **26**: No. 1, 218-222(1 Jul 1982).

We evaluate the decays of W^+ and Z^0 bosons into chi^{++}, the doubly charged member of the scalar triplet in the Gelmini-Roncadelli model in which spontaneously broken B-L symmetry gives Majorana masses to neutrinos. For M(chi^{++})<28 GeV, the branching fractions exceed 4% for $W^+ \rightarrow$chi^{++}chi$^-$ and 2% for $Z^0 \rightarrow$chi^{++}chi^{--}. Sequential chi$^{++} \rightarrow l_1^+ l_2^+$ leptonic decays could be substantially higher than previously recognized and could be dominant. Decay distributions for leptons of this origin are calculated for p-barp colliders. We also evaluate t→bchi^{++}chi$^-$ decay.

58527 Hydrogen-antihydrogen oscillations, double proton decay, and grand unified theories. Arnellos, L.; Marciano, W.J. (Department of Physics, University of Illinois, Chicago, Illinois 60680). *Physical Review Letters;* **48**: No. 25, 1708-1711(21 Jun 1982).

The ΔB = ΔL = 2 processes of hydrogen-antihydrogen oscillation and $pp \rightarrow e^+e^+$ or $\mu^+\mu^+$ (double proton decay) in grand unified theories are examined. Although these reactions are very suppressed in the minimal SU(5) model, their rates may be significantly increased by appending a 50-plet of Higgs scalars. In that case relatively light color sextet and doubly charged colorless scalars might mediate $pp \to e^+e^+$ or $\mu^+\mu^+$ at a rate observable in ongoing proton decay experiments. Consequences of this scenario are discussed.

58528 **Baryon masses in a relativistic quark-diquark model.** Lichtenberg, D.B.; Namgung, W.; Predazzi, E.; Wills, J.G. (Physics Department, Indiana University, Bloomington, Indiana 47405). *Physical Review Letters;* **48**: No. 24, 1653-1656(14 Jun 1982).

Masses of ground-state spin-3/2 baryons are calculated in a relativistic quark-diquark model with a potential motivated by QCD. The parameters of the model are determined by fitting vector-meson masses, and so the calculation for baryons contains no free parameters. Results are in rather good agreement with experiment. Moreover, starting from dynamical quark masses close to the so-called current masses, effective quark masses are obtained in the right range to be identified with constituent masses.

58529 **Possible evidence for substantial nonperturbative quantum-chromodynamic effects.** Barnett, R.M. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review Letters;* **48**: No. 24, 1657-1659(14 Jun 1982). Contract AC03-76SF00515.

A search for nonperturbative effects in the structure functions of deep-inelastic scattering reveals substantial effects which could be due to important physical phenomena or to systematic errors in the experiments. In either case the measurements of α/sub s/ and Λ are seriously jeopardized. $F_2(\mu N)$, $F_2(\nu N)$, and $xF_3(\nu N)$ are examined.

58530 **Bounds on M/sub Z//sub 1,2/ in any SU(2)/sub L/xSU(2)/sub R/xU(1)/sub B/-L gauge model.** Barger, V.; Ma, E.; Whisnant, K. (Department of Physics and Astronomy, University of Hawaii at Manoa, Honolulu, Hawaii 96822). *Physical Review Letters;* **48**: No. 23, 1589-1592(7 Jun 1982). Contract AM03-76SF00235;AC02-76ER00881.

In the known fermions transform under SU(2)/sub L/ xSU(2)/sub R/xU(1)/sub B/-L, then the two neutral vector gauge bosons must satisfy the bounds 83 GeV<M/sub L/1<116 GeV and M/sub Z/2>200 GeV. In addition, if mixing is negligible for the two charged vector gauge bosons, then 75 GeV<M/sub W/ 1<97 GeV. These results come directly from analyzing existing experimental data and do not depend on any further theoretical assumptions, such as the value of g/sub L//g/sub R/ or the choice of Higgs—boson representations.

58531 **Neutrinoless double-beta decay and muonium-antimuonium transitions.** Halprin, A. (Physics Department, University of Delaware, Newark, Delaware 19711). *Physical Review Letters;* **48**: No. 19, 1313-1316(10 May 1982).

The effective coupling for muonium-antimuonium transitions is calculated from analogous couplings obtained in recent analyses of nuclear double beta decay. An effective four-fermion coupling as large as 10G/sub F/ is found, which should be experimentally accessible with use of muonium in vacuum.

58532 **Questions in a microscopic theory of pion production/absorption.** Banerjee, M.K. (University of Maryland, College Park, Md. 20742). *AIP (American Institute of Physics) Conference Proceedings;* **79**: No. 1, 37-46(10 Mar 1982).

In this talk we show that in the treatment of nuclear processes involving pions, such as pion production/absorption or exchange currents, one should use for the πNN vertex function $g\pi(q^2)\gamma_5$tau/sub α/, where q is the pion four-momentum and g/sub π/(m^2/sub π/)≃13.4 is the pion-nucleon couping constant. The result is independent of the form and details of any interaction Lagrangian. We show that the difference between g/sub π/(q^2)$\gamma_5$tau/sub α/ and the fully dressed πNN vertex function contributes to amplitudes involving more bosons, e.g., scattering amplitudes ($\pi N \to \pi N$), production amplitudes ($\pi N \to \pi\pi N$), etc. Such contributions are mediated through either seagull terms or P11 intermediate states. We point out that it is neither necessary nor practical to calculate these partial contributions to scattering and production amplitudes. One can always exploit other approaches, theoretical and phenomenological, to make reasonably good models for the full amplitudes.

58533 **Quarks in nuclei.** Miller, G.A. (University of Washington, Seattle, WA 98195). *AIP (American Institute of Physics) Conference Proceedings;* **79**: No. 1, 47-57(10 Mar 1982).

A brief discussion of the relevance of quark degrees of freedom in Nuclear Physics is presented. Pertinent aspects of bag models of baryons are reviewed, and a six-quark bag model study of the reaction $pp \to d\pi^+$ is made.

58534 **Implications of mass-dependent renormalization group parameters for conventional QCD phenomenology.** Edwards, B.J. (Argonne National Lab., IL (USA). High Energy Physics Div.); Gottschalk, T.D. (California Inst. of Tech., Pasadena (USA)). *Nuclear Physics [Section] B;* **196**: No. 2, 328-364(8 Mar 1982).

The effects of quark mass dependence in the momentum-subtracted beta function and anomalous dimensions of quantum chromodynamics are investigated. We examine the sensitivity of predicted quark and gluon moments for deep inelastic scattering to changes in the prescriptions used in defining the mass-dependent renormalization group parameters and we discuss interpretations of the resulting differences. Simple algorithms are presented in which the mass-dependent evolution of parton moments and the effective coupling can be approximated by massless formulae with carefully chosen thresholds for exciting additional quark flavors. We examine the expected nature of heavy quark components in the nucleon's sea, with particular attention given to the strange and charmed sea. The inherent scheme dependence in the definition of heavy quark parton distributions is also discussed.

58535 **Infrared properties of a quark gas.** Kapusta, J.I. (Los Alamos Scientific Lab., NM (USA)). pp 395-403 of Statistical mechanics of quarks and hadrons. Proceedings of an International Symposium. Satz, H. (Bielefeld Univ. (Germany, F.R.). Fakultaet fuer Physik) (ed.). Amsterdam, Netherlands; North-Holland (1981).

From International symposium on statistical mechanics of quarks and hadrons; Bielefeld, F.R. Germany (24 Aug 1980).

The infrared properties of a quark gas at finite density are studied using renormalization-group-improved perturbation theory. The running coupling constant shows color charge screening in the infrared region with no Landau pole. Asymptotic freedom is recovered in the ultraviolet region which allows one to relate the scale parameter Λ, as determined by scattering experiments, to the running coupling constant in the many-body system. Possible ambiguities of the perturbation expansion in the many-body system are discussed.

58536 **Issues in massive lepton pair production in hadronic interactions - 1980.** Berger, E.L. (Argonne National Lab., IL (USA)). pp 71-96 of Elementary constituents and hadronic structure. Proceedings v.1 of the 15. Rencontre de Moriond, les Arcs, 9 - 21 Mar 1980. Tran Thanh Van, J. (ed.). Dreux, France; Editions Frontieres (1980).

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

A discussion is presented of issues of current importance in the theory and phenomenology of massive lepton pair production in hadronic interactions. The relevance of higher-twist inverse-power terms for all constituent scattering processes is emphasized.

58537 **(PB—82-161555) Hyperfine splittings of bag model gluonia.** Barnes, T.; Close, F.E.; Monaghan, S. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 27p. (RL—81-086). NTIS, PC A03/ MF A01.

Recently there has been an upsurge of interest in gluonia - color singlet bound states of two or more gluons - and speculation that low lying 0(-+) and 2(++) states may already have been manifested at 1440 and 1640 MeV. The MIT bag model has been cited as a guide to gluonium masses; it yields degenerate 0(++), 2(++) states at about 1 GeV and 0(-+), 2(-+) states at about 1300 MeV before hyperfine splitting effects arizing from single gluon exchange and the four gluon interaction are included. The recently developed formalism for QCD perturbation theory in a finite spherical cavity enable the effects of gluon exchange to be computed directly. This is now applied to gluonia.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 58519

58538 **(ITEF—66(1980)) Instanton solutions in chiral models.** Perelomov, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 43p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702236.

The review of instanton solutions in two-dimensional chiral models of the field theory is presented. The simplest chiral model - the n vector -field model is considered. Main attention is given to the study of instanton solutions in the case of common chiral models. The properties of instanton solutions in the CPsup(n) model are briefly discussed.

58539 **(ITEP—73(1981)) Rishon gauge theory.** Okun, L.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702238.

Rishon model with SU(3)sub(H) x SU(3)sub(c) gauge symmetry is investigated. Corollaries of the global U(6)-symmetry of this model are discussed. Two and three rishon states are studied. The strong instability of the proton and the existence of light sextet quarks is revealed.

58540 **(JINR—R-2-81-249) Symmetries, conservation laws and invariant solutions of nonlinear evolution equations.** Mel'nikov, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701965.

An infinite-dimensional commutative group of invariance of all equations obtained from the condition of consistency of first-order matrix operators has been found. It is shown that the local conservation laws derived earlier follow just from these symmetries. Equations for invariant solutions are considered, and the group of symmetry and first integrals of these equations are found.

58541 **Preon models with dynamical symmetry breaking.** Schellekens, A.N.; Kang, K.; Koh, I. (Fermi National Accelerator Laboratory, P. O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **26**: No. 3, 658-673(1 Aug 1982). Contract AC02-76ER03130.

We have investigated all composite models based on complex, anomaly-free, and asymptotically free representations of the gauge groups SU(3) to SU(8), SO(4N+2), and E_6, with not more than two different preons. We discuss in detail the role of Fermi statistics in the determination of the (meta)flavor representations of the composites. Under certain assumptions about the possible ground states, the solutions to 't Hooft's anomaly equations are presented for the complete flavor group and all non-Abelian subgroups, to which the flavor group can break. We find several models which satisfy anomaly matching when the flavor group is broken by the simplest condensate.

58542 **Hydrogen-antihydrogen oscillations and spontaneously broken global B—L symmetry.** Mohapatra, R.N.; Senjanovic, G. (Physics Department, The City College of the City University of New York, New York, New York 10031). *Physical Review Letters;* **49**: No. 1, 7-10(5 Jul 1982). Contract AC02-76CH00016.

Within the framework of an SU(2)/sub L/xU(1)xSU(3)/sub c/ gauge model with suitably extended Higgs sector, the possibility of oscillations between neutral matter and antimatter, such as neutron-antineutron and hydrogen-antihydrogen systems, is discussed. This model incorporates the spontaneous breakdown of global B—L symmetry associated with a Majoron, and as a result, a relation between n-n-bar mixing, H-H mixing, and the mass of the electron neutrino is obtained. With present limits on tau/sub n/-n-bar, tau/sub HhyphenH/> or $\approx 10^{13}$ yr is predicted.

58543 **Spontaneous breakdown and the scalar nonet.** Scadron, M.D. (Physics Department, University of Arizona, Tucson, Arizona 85721). *Physical Review [Section] D: Particles and Fields;* **26**: No. 1, 239-247(1 Jul 1982). Contract AC02-80ER10663.

In the context of the QCD quark model and on the basis of dynamical Bethe-Salpeter ladder graphs, we suggest that (i) the existence of the scalar q-barq hadron multiplet, like the pseudoscalar q-barq multiplet, is a direct consequence of dynamical spontaneous breakdown of chiral symmetry with a chiral-limiting nonstrange mass scale of m/sub sigmaNS//sup CL/ = 2m/sub dyn/ roughly-equal630 MeV, (ii) the lifting of the nonstrange σ-δ degeneracy is expected from the s-wave quark-gluon annihilation diagram, and (iii) the observed σ-S* mixing follows from the existence of the p-wave scalar quark-annihilation diagram. The resulting predicted 0q-barq nonet is then σ(750 MeV), κ(800), S*(980), and δ(985), in agreement with data for the resonant masses, the mixing angle, and also decay widths except for the κ(800).

58544 **Chiral lagrangian for deep mine physics.** Claudson, M.; Wise, M.B. (Harvard Univ., Cambridge, MA (USA). Lyman Lab. of Physics); Hall, L.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics [Section] B;* **195**: No. 2, 297-307(15 Feb 1982).

The chiral lagrangian for baryon number violating nucleon decay is derived and applied to nucleon decays into strange and non-strange final states. The uncertainties in our predictions are discussed.

58545 **Classification of Wigner operators by a new type of weight space diagram.** Biedenharn, L.C. (Duke Univ., Durham, NC); Louck, J.D. pp 55-72 of Symmetries in science. Gruber, B.; Millman, R.S. (eds.). New York, NY; Plenum Publishing Corporation (1980).

The status of the use of the Wigner operator approach to unitary groups is reviewed. The main ideas, techniques and known results are sketched. The way in which the weight patterns for SU(3) appear as the classifying concept for a new family of polynomials defined by SU(3) canonical tensor operators is discussed in detail.

58546 **Weakly coupled fields: a more active view.** Ward, B.F.L. (Stanford Linear Accelerator Center, CA (USA); Purdue Univ., Lafayette, IN (USA). Dept. of Physics). *Nuovo Cimento [Sezione] A;* **48**: No. 3, 299-313(1 Dec 1978).

A more active formulation of the gauge-theoretic view of the weak and electromagnetic interactions of fundamental fermions is presented using as a guide the suppression, in nature, of certain matrix elements of strangeness-changing neutral currents between two single-hadron states and/or between a single-hadron state and the vacuum. The principal result of our formulation is that the observed rate for Ksub(L)→anti$\mu\mu$ allows us to predict, in the free-quark approximation, the value of (msub(KL) - msub(KS))/msub(K) within 10% by using the Quigg-Jackson bound.

6454 Field Theory

REFER ALSO TO CITATION(S) 58296, 58446, 58456, 58485, 58523, 58524, 58529, 58533, 58534, 58537, 58543, 58713, 58792

58547 **(CEA-CONF—5947) Lattice gauge theory.** Itzykson, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Jul 1981. 12p. (CONF-8106228—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702222.

From Conference on grand unified theories and related topics; Kyoto, Japan (29 Jun 1981).

The different parts of this paper are the following: lattice quantization; strong coupling expansions and mean field approximation; duality and topological excitations; roughening.

58548 **(CNRS-CPT—81-P-1316) Gluonic corrections to quark vacuum condensate contributions to two-point functions in QCD.** Pascual, P.; de Rafael, E. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jul 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702225.

We present the gluonic corrections to quark vacuum condensate contributions to various types of current correlation functions. Their relevance to the first Weinberg sum rule is discussed. A new derivation of the relation between the A_1-mass and the q-mass is presented. The higher order corrections to the so-called non-perturbative quark mass are also discussed.

58549 **(CPT—81/P.1309) Characterization of the fundamental group of a differentiable manifold by the action of its group of diffeomorphisms.** Donato, P. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jul 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82904029.

Portions of document are illegible.

Let X be a connected differentiable manifold and Diff(X) the corresponding group of diffeomorphisms. Starting from a construction of the universal covering space of the neutral component of Diff(X) we establish that the fundamental group of X is isomorphic with the group of components of the isotropy subgroup of a point under the transitive action of this covering on X.

58550 **(HU-TFT—81-31) Gauge hierarchies of the SU(N) grand unification.** Chaichian, M.; Kolmakov, N.Yu.; Nelipa, N. F. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 23 Oct 1981. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702702.

Structure of spontaneous breaking of SU(N) gauge symmetry for grand unification is investigated. The obtained results are applied to the analysis of SU(8) symmetry for which possible ways of breaking and intermediate symmetries are considered. It is assumed that the SU(8) group unifies the subgroups of colour, standard electroweak and horizontal symmetries. We find conditions which are necessary to impose on the vacuum expection values of Higgs multiplets for providing arbitrary breaking pattern of SU(N) symmetry and conserving any intermediate symmetry. If in the considered SU(8) models fermions and mirror fermions do not violate the (V-A) and (V+A) structure of weak interactions, then their masses should not be greater than approx. 10^2 GeV. It is also shown that the contributions of fermion and scalar multiplets to the renormalization group equation for the coupling constant of any subgroup of SU(N) are identical. Renormalization group identities for the case of arbitrary SU(N) breaking are given. Using these identities one can calculate the value of the masses for the breaking of the intermediate symmetries in the SU(8) models, and also exclude part of the possible breaking patterns.

58551 **(IFVE-OTF—81-101) Collective coordinate method in the relativistic string theory.** Pron'ko, G.P.; Razumov, A.V.; Taranov, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702234.

Classical theory of a string is investigated by means of the collective coordinate method. The total solution of classical Hamiltonian equations of a string is given. For an open string a complete set of gauge invariant is derived. At the classical level the connection between two standard methods of string quantization is established. For a closed string a broad class of gauge invariant quantities is obtained.

58552 **(INFN/AE—80/1) Geometrical aspects of nonlinear sigma models.** Percacci, R. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy); Trieste Univ. (Italy). Ist. di Fisica Teorica). 15 Mar 1980. 67p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82902986.

Like general relativity and gauge theories, the nonlinear sigma models are examples of field theories with a geometric interpretation; their study involves the use of many ideas from the theories of harmonic maps, Lie groups, symmetric spaces, fibre bundles and differential geometry in general. The present work is intended to give an account of some of these aspects, together with an introduction to the mathematical tools which are necessary to understand them. It is focused essentially on two problems: derive various equivalent forms for the action functional, and give a global definition of nonlinear sigma model as a field theory defined on a nontrivial fibre bundle over spacetime. This broader definition allows the fields to have a state of twistedness and thus enlarges considerably the class of topological configurations of the model.

58553 **(INIS-mf—7116, pp vp) Su(2) Yang-Mills theory in (1+1)-dimensions: a finite lattice approach.** Hamer, C.J. (Australian National Univ., Canberra. Dept. of Theoretical Physics:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58554 **(INIS-mf—7116, pp vp) Grand unified models.** Kenny, B.G. (Western Australia Univ., Nedlands:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58555 **(JINR—E-2-81-294) Covariant three-dimensional equation for fermion-antifermion system. Part 1.** Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701850.

A covariant three-dimensional equation is obtained for the fermion- antifermion wave function on the basis of the covariant Hamilton formulation of quantum field theory. The consideration is carried out in the framework of the diagram technique. Transition to the three-dimensional form is achieved through the use of variables of the Lobachevsky momentum space.

58556 **(JINR—E-2-81-499) Quantum nonlocal conserved charges for supersymmetric generalized nonlinear sigma models.** Zaikov, R.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702492.

It is shown that the higher nonlocal conserved charges for O(N) and O(N) x O(N) nonlinear sigma models survive in the case of quantization. The same is true also for any sigma model for which there exist the asymptotical states and dynamical mass generation.

58557 **(JINR—R-2-81-303) Contribution of the vacuum polarization into the abnormal electron magnetic moment and summation of the perturbation theory series.** Ilchev, A.S.; Mitryushkin, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702493.

A method is proposed to sum up asymptotic series of the perturbation theory, that is based on the finite convergence radius of the pertubation theory regularized series in some models of the field theory with fermions. In terms of the one-loop approximation in the quantum electrodynamics the contribution of vacuum polarization into the abnormal electron magnetic moment is explained into an asymptotic sign-constant series with factorially growing coefficients. The regularized series with a finite convergence radius is summed up. The expression obtained is analytically extended with respect to the interaction constant beyond the convergence radius, where the regularization is cancelled. It is noted, that the calculational scheme proposed can be employed in the two-loop, three-loop etc. approximation for the polarization operator.

58558 (JINR—R-2-81-401) Anomalous dimension quark counting in higher orders of QCD. Avaliani, I.S.; Matveev, V.A.; Slepchenko, L.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01.

The problem of the influence of QCD higher approximations on asymptotic behaviour of cross-sections of inclusive processes with great momenta transferred is studied. It is shown that the type of logarithmic factors characterizing deviation from inclusive cross sections scaling is determined by quark structure of hadrons and that the two-loop corrections counting in distribution functions and quark fragmentation does not destroy universality of the anomalous dimension quark counting.

58559 (KMU-HEP—81-08) Logarithmic asymptotics in quantum chromodynamics. Kirschner, R. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Sep 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702025.

Double-logarithmic and logarithmic contributions to the quark form factor and to quark scattering and annihilation amplitudes are summed in all orders. The main part of the single-logarithmic contributions can be absorbed into effective couplings.

58560 (NBI-HE—81-39) Two loop calculations for the propagators of gluonic currents jsub(PG)=αGsub($\mu\gamma$)sup(a)[Gsub(a)sup($\mu\gamma$)(mean)] and jsub(SG)=[$\beta(\alpha)/\alpha$]Gsub($\mu\gamma$)^2. Kataev, A.L.; Krasnikov, N.V.; Pivovarov, A.A. (Niels Bohr Inst., Copenhagen (Denmark)). Oct 1981. 21p. NTIS (US Sales Only), PC A02/MF A01.

The authors calculate two loop corrections to the propagators of gluonic currents jsub(PG)=αGsub($\mu\gamma$)sup(a)[G sub(a)sup($\mu\gamma$)(mean)] and jsub(SG)=[$\beta(\alpha)/\alpha$]Gsub($\mu\gamma$)^2. The results of the calculations are used for finding the connection between the characteristic scales of quark and gluonic worlds in perturbative QCD and estimate of the mass of the first radial excitation of eta'-meson (the authors obtain (msub(eta') = 1.45 GeV)).

58561 (NBI-HE—81-40) Dual models as saddle point approximations to Polyakov's quantized string. Durhuus, B.; Nielsen, H.B.; Olesen, P.; Petersen, J.L. (Niels Bohr Inst., Copenhagen (Denmark)). Oct 1981. 20p. NTIS (US Sales Only), PC A02/MF A01.

It is shown that if the metric becomes singular on the boundary, then Polyakov's quantized string theory has a saddle point. This leads to an off-shell Greens function, the S-matrix of which is the standard dual (Veneziano) model.

58562 (NBI-HE—81-41) Variational estimation of the mass gap in U(1) and SU(2) gauge theories in 2+1 dimensions. Patkos, A. (Niels Bohr Inst., Copenhagen (Denmark)). Oct 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702244.

A recently proposed variational Ansatz is used to compute plaquette-plaquette correlation functions. The results are compared to Monte Carlo values (SU(2)) and to a rigorous result of Goepfert and Mack (U(1)).

58563 (NBI-HE—81-42) Some comments on 't Hooft-Polyakov monopoles. Krasnikov, N.V. (Niels Bohr Inst., Copenhagen (Denmark)). Oct 1981. 11p. NTIS (US Sales Only), PC A02/MF A01.

The author describes a modification of the Georgi-Glashow model in which there are no 't Hooft-Polyakov monopoles. The main shortcoming of the proposed model is an absence of renormalizability. It is pointed out that even in the renormalizable models like SU(5), an account of quantum effects may lead to the lack of monopoles.

58564 (NBI-HE—81-48) Some approximate calculations in SU$_2$ lattice mean field theory. Hari Dass, N.D.; Lauwers, P.G. (Niels Bohr Inst., Copenhagen (Denmark)). Dec 1981. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702245.

Approximate calculations are performed for small Wilson loops of SU$_2$ lattice gauge theory in mean field approximation. Reasonable agreement is found with Monte Carlo data. Ways of improving these calculations are discussed.

58565 (NBI-HE—81-52) Mean field with corrections in lattice gauge theory. Flyvbjerg, H.; Zuber, J.B.; Lautrup, B. (Niels Bohr Inst., Copenhagen (Denmark)). Dec 1981. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702246.

A systematic expansion of the path integral for lattice gauge theory is performed around the mean field solution. In this letter the authors present the results for the pure gauge groups Z(2), SU(2) and SO(3). The agreement with Monte Carlo calculations is excellent. For the discrete group the calculation is performed with and without gauge fixing, whereas for the continuous groups gauge fixing is mandatory. In the case of SU(2) the absence of a phase transition is correctly signalled by mean field theory.

58566 (NBI-HE—82-1) Confinement and magnetic condensation for N → infinity. Olesen, P. (Niels Bohr Inst., Copenhagen (Denmark)). Jan 1982. 27p. (CONF-811248—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702247.

From Conference on monopoles in quantum field theory; Trieste, Italy (11 Dec 1981).

The author discusses why magnetic condensation is necessary for confinement. Using the Makeenko-Migdal equation he then indicates that for N → infinity (in SU(N)) one has a condensate of magnetic strings in the QCD vacuum.

58567 (NBI-HE—82-2) Phase structure of SU/sub (n)/Z/sub (n) x SU/sub (n)/Z/sub (n)/ spin systems in two dimensions. Hari Dass, N.D.; Patkos, A.; Deak, F. (Niels Bohr Inst., Copenhagen (Denmark)). Jan 1982. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702248.

The ground state of the two dimensional chiral adjoint spin systems is studied using the most general nearest neighbour ansatz for the eigenfunctions of the transfer matrix. The parameters entering this ansatz are determined variationally and the resulting phase structure is in close agreement with the results of Monte Carlo simulations.

58568 (NBI-HE—82-3) Polyakov's quantized string with boundary terms. II. Durhuus, B.; Olesen, P.; Petersen, J.L. (Niels Bohr Inst., Copenhagen (Denmark)). Jan 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702249.

Previously the authors computed boundary terms due to the conformal anomaly which are needed in Polkakov's method for calculating averages of functionals defined on surfaces. In this paper the authors complete the calculation so as to obtain the total action with all boundary terms in the bosonic case.

58569 (PB—82-177619) Experimental tests of gauge theories: lectures presented at the CERN-JINR joint school of physics, Hanko, Finland, 6-19 June 1981. Perkins, D.H. (Oxford Univ. (UK). Nuclear Physics Lab.). 1981. 84p. NTIS, PC A05/MF A01.

Our present thinking is that all theories of the interactions between the fundamental constituents of the universe are renormalizable gauge theories. In these lectures, the author's task is to try to critically assess the experimental evidence for this conclusion; to compare the data in detail with the predictions of the gauge theories of the electroweak and strong interactions; and to discuss the prospects for obtaining experimental evidence relating to the schemes (GUTs) unifying strong and electroweak interactions.

58570 (PM—81/11) Wave-function renormalization for coupled particles. Peyranere, M.C.; Talon, M. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). 1981. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82904244.

Formulas are given for conventional wave function renormalization of coupled systems of scalars, fermions, and vectors.

58571 (RL—81-087) Jets and tests of QCD in e^+e^- experiments. Marshall, R. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Jul 1981. 32p. (CONF-810760—20). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702028.

From International conference on high energy physics; Lisbon, Portugal (9 Jul 1981).

The current status of QCD tests using PETRA data is presented in three sections. The first section covers essentially qualitative comparisons using Q plots, thrust and psub(T) distributions and energy or momentum flow. The second section describes the quantitative determination of αsub(s) and the third section covers the scalar-vector tests of QCD.

58572 (RRK—80-15) Infrared singularity in the electron propagator in quantum electrodynamics. Harada, K.; Kubo, R. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Oct 1980. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702495.

Infrared singularity in the electron propagator is studied by means of the perturbation calculation exploited by Grammer and Yennie. The result agrees with those derived by nonperturbative methods. The difference between our result and the so-called exponentiation law is discussed together with the Ward-Takahashi identity.

58573 (VE—1-Preprint) New method of investigating some nonlinear spectral equations. Ushveridze, A.G. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). Feb 1981. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702250.

Mathematical substantiation of previously proposed method of solution of nonlinear spectral equations arising at the investigation of instanton structure of scalar euclidian field theories with power nonlinearity is given. A series of sufficient conditions of existence of infinite multiplicity of solutions of nonlinear equations considered is established. Generalization for the case of nonlinear equations of the known in the theory of linear spectral equations principle of minima maximum is obtained. The possibility of using iterative methods of obtaining some solutions is proved. The mathematical apparatus used is taken from the field of modern functional analysis which is devoted to Sobolev embedding theorems and their application.

58574 (WIS-Ph—81/54) Anomaly equations and the persistent mass condition. Cohen, E.; Frishman, Y. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Nov 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702496.

Vector SU(Nsub(c)) gauge theories with nsub(f) flavors in the fundamental representation are considered. We prove that if the persistent mass condition is assumed, the two anomaly equations are identical and flavor independent for nsub(f)>=3. Integer solutions exist only for nsub(f)=2. The necessity of a separate discussion for 2<=nsub(f)<=Nsub(c) is explained.

58575 Real-space renormalization group: An adiabatic method of thinning high-frequency modes. Ben-Menahem, S. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **26**: No. 2, 455-467(15 Jul 1982). Contract AC03-76SF00515.

A new adiabatic method for improving iterative blocking-truncation approximations in lattice models is presented, and applied to a test model. In this approach, the high-frequency (fast) modes are frozen into wave functions that change with the slow modes.

58576 Operator-product expansion and vacuum instability. Gupta, S.; Quinn, H.R. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **26**: No. 2, 499-504(15 Jul 1982). Contract AC03-76SF00515.

This paper examines the operator product using the example of scalar field theories with unstable vacuums. We find that an operator-product expansion about the unstable vacuum, with the additional assumption that nontrivial operators subtracted with respect to this vacuum have nonvanishing expectation value in the physical vacuum, does not reproduce the predictions of the operator-product expansion about the stable vacuum, except for the leading-twist contribution. We discuss the implications of this for applications of the operator-product expansion in QCD.

58577 Conformally invariant quantization of the Liouville theory. Curtright, T.L.; Thorn, C.B. (Physics Department, University of Florida, Gainesville, Florida 32611). *Physical Review Letters;* **48**: No. 19, 1309-1313(10 May 1982).

The Liouville theory is quantized with use of Fock space methods, an infinite set of charges L/sub n/, n = 0, +- 1,..., is constructed which represents the conformal algebra in two dimensions, and consequences of this algebra are discussed. It is then argued, with use of variational methods in Fock space, that the spectrum of the Liouville Hamiltonian is continuous, and that there exist energy eigenstates obeying the constraints L/sub n/'E> = 0, n>0.

58578 Internal retardation. Grotch, H.; Kazes, E. (Pennsylvania State Univ., University Park (USA). Dept. of Physics); Rohrlich, F. (Syracuse Univ., NY (USA). Dept. of Physics); Sharp, D.H. (Los Alamos Scientific Lab., NM (USA)). *Acta Physica Austriaca;* **54**: No. 1, 31-38(1982).

It is suggested that the quantum electrodynamics of point particles be formulated as the point particle limit of a theory of extended particles, and that this limit be taken on the quantum level rather than the classical level. One is thus required to include the retarded interaction within the extended particle. In the nonrelativistic approximation, this method leads to a vanishing self-energy and to the absence of run-away and preacceleration effects, as has been shown previously. A comparison with the conventional perturbation methods of quantum electrodynamics is made.

58579 Measuring the scale parameter of quantum chromodynamics at CHEER. Krauss, L.M. (Massachusetts Inst. of Technology, Cambridge). *Canadian Journal of Physics;* **59**: No. 11, 1769-1773(1981). Contract AC02-76ER03069.

The possibility of measuring the scale parameter of quantum chromodynamics, Λ/sub s/, at CHEER is discussed. Rationale for the measurement of this quantity are given, along with a discussion of the theoretical difficulties involved. The measurement of the Q^2 dependence of structure functions and their moments, and methods of measuring α/sub s/ and its Q^2 evolution, are discussed, and arguments are given for the advantages and disadvantages of going to high Q^2 values at CHEER. It is concluded that while sensitivity to Λ is lowered at high Q^2, CHEER will, in principle, be able to provide the first clean measurements of Λ, free from almost all the theoretical confusion involved in interpretations of present data.

58580 (PB—82-161563) The MIT bag can accommodate the θ(1640) and I(1440) as glueballs. Barnes, T.; Close, F.E.; Monaghan, S. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 9p. (RL—81-090). NTIS, PC A02/MF A01.

QCD perturbation effects at O (alpha sub s) are studied for gluonia in the MIT bag. If alpha sub s > 0.54 then the 2(++) is heavier than the 0(-+) in line with the theta (1640) and i (1440) states. The observed splitting and absolute magnitudes are consistent with a bag radius about 1 fm. A scalar glueball is predicted at 1 GeV and may mix with S*(980). (Copyright Science and Engineering Research Council 1981.)

6455 Scattering Theory

REFER ALSO TO CITATION(S) 58505

58581 (JINR—R-4-81-199) **Limiting relation in theory of three-particle scattering.** Belyaev, V.B.; Solovtsova, O.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702242.

The behaviour of the three-particle scattering length in the limit of the zero binding energy of a target under the condition that the interaction of an incident particle with target particles has no resonance character is considered. It is shown that rescattering vanish in this limit. Calculations of the three-particle scattering lengths in πd and lambdad systems are given.

58582 (NP—2906226) **Zakharov-Shabat inverse-scattering problem with a polynomial spectral dependence in the potential.** Guillaume, M.O.; Jaulent, M. (Montpellier-2 Univ., 34 (France)). Sep 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82906226.

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The inverse scattering problem for the Zakharov-Shabat system is considered. It is solved by reduction to the inverse scattering problem for 2 coupled Zakharov-Shabat systems in a 4n-dimensional space.

65 PHYSICS RESEARCH

REFER ALSO TO CITATION(S) 57585

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 57083, 57848

58583 (DOE/ER/70024—T1) **UCLA intermediate-energy nuclear physics. Annual reports, February 1, 1978-January 31, 1982. Final report.** (University of Southern California, Los Angeles (USA). Dept. of Physics). 1982. Contract AT03-76ER70024. 142p. NTIS, PC A07/MF A01. Order Number DE82018247.

Portions of document are illegible.

Research in intermediate energy nuclear physics at LAMPF and at the Bevalac/Betatron and ZGS from February 1, 1978, through January 31, 1982. (GHT)

58584 (IKF—41) **Annual Report 1981.** Bethge, K.; Steuer, E. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik). 1982. 149p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

This annual report contains extended abstracts about the work done at the named Institute, reports about accelerators and technical facilities of this Institute, and a list of publications. The scientific work concerns nuclear structure and nuclear reactions, high energy heavy ion physics, heavy ion atomic physics, nuclear solid state physics, solid-state track detectors, applications of nuclear methods and mass spectroscopy, the development of ion sources, instrumental developments, and interdisciplinary cooperation. See hints under the relevant topics.

58585 (INDC(NDS)—116/GandP(No.7)) **Progress in fission product nuclear data. Information about activities in the field of measurements and compilation/evaluations of fission product nuclear data (FPND).** Lammer, M. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jun 1981. 191p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE82702454.

This is the seventh issue of a report series on Fission Product Nuclear Data (FPND) which is published by the Nuclear Data Section (NDS) of the International Atomic Energy Agency (IAEA). The purpose of this series is to inform scientists working on FPND, or using such data, about all activities in this field which are planned, ongoing, or have recently been completed. The present issue contains also a section with some recent references relative to fission product nuclear data, which were not covered by the contributions submitted. The types of activities being included in this report are measurements, compilations and evaluations of: fission product yields (neutron induced and spontaneous fission); neutron reaction cross sections of fission products; data related to the radioactive decay of fission products; delayed neutron data of fission products; and lumped fission product data (decay heat, absorption etc.). The sixth issue of this series has been published in June 1980 as INDC(NDS)-113/G+P. The present issue includes contributions which were received by NDS between 1 August 1980 and 25 May 1981.

58586 (INIS-mf—6968) **Proceedings of the EPS topical conference on large amplitude collective nuclear motions.** Kiss, A.; Nemeth, J.; Zimanyi, J. (eds.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1979. 420p. (CONF-790660—Vol.1). NTIS (US Sales Only), PC A18/MF A01. Order Number DE82780647.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

The papers presented were entered in the data base separately. (WHK)

58587 (INIS-mf—7058) **Proceedings of the EPS topical conference on large amplitude collective nuclear motions.** Kiss, A.; Nemeth, J.; Zimanyi, J. (eds.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1979. 458p. (CONF-790660—Vol.2). NTIS (US Sales Only), PC A20/MF A01. Order Number DE82780648.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

Individual items in scope for the data base were entered separately. (DLC)

58588 (INIS-mf—7102) **Annual report, 1980.** (Laval Univ., Quebec City (Canada). Lab. de l'Accelerateur van de Graaff). Dec 1980. 131p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780707.

This report covers the period between Nov. 1, 1979 and Nov. 1, 1980. Work was carried out in the fields of pure and applied nuclear physics, atomic physics, and radiobiology. Thirty-four projects belonging to Laval researchers and twelve run by external users are under way. Thirty research subjects pursued during the year are described, and a list of publications is included.

58589 (INIS-mf—7103) **McMaster Accelerator Laboratory annual report, 1980.** (McMaster Univ., Hamilton, Ontario (Canada). Tandem Accelerator Lab.). 1980. 131p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780708.

This Annual Report covers research carried out on the laboratory's three accelerators during the period November 1979 to October 1980. The contents include reports of the research completed or in progress during the year, a summary of the operation and development of the facilities, a list of persons associated with the laboratory and a list of publications for the last two years. A major new development during the year has been the development and use of a new multiplicity filter. This consists of a detector array built on the Lotus beam line together with the associated electronics to allow detection of mulitple gamma-ray coincidences. This allows study of high-spin states of rotational bands in nuclei. Measurements have allowed identification of bands in ^{159}Tm. A large part of the research programme has been based on reaction studies with beams of both polarized and unpolarized protons and deuterons. A short period of operation with a tritium beam took place in order to implant tritium in both Si(Li) and Ge(Li) detectors for further studies of the β-decay spectrum but no other experimental work took place with this beam. A major run with tritium is planned for early in 1981. There has been considerable collaboration with colleagues in other institutions with experiments being carried out at both McMaster and other institutions.

58590 (INIS-mf—7113) **Annual report 1981.** (Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Experimentalphysik). Dec 1981. 50p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780697.

This annual report contains short descriptions of the work done at the named institute. These concern the study of hyperfine interactions, experiments with synchroton radiation, experiments at storage rings, and experiments at CERN. Furthermore, a list of publications, contributions to conferences and these is presented. (HSI).

58591 (INIS-mf—7116) **Ninth AINSE nuclear physics conference.** (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). 1982. 83p. (CONF-820251—Absts.). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780693.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

Individual items from the conference were prepared separately for the data base. (GHT)

58592 (Juel-Spez—146) **Annual report 1981.** Gruemmer, F.; Mayer-Boericke, C.; Schult, O. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Mar 1982. 156p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

This annual report contains extended abstracts about the work performed at the named Institute together with a list of publications, conference contributions, and internal reports. The work concerns nuclear reactions, nuclear spectroscopy, nuclear structure, solar energy, the isochronous cyclotron, the spectrometer BIG KARL, radiation detectors, software developments, electronic circuits, radiation protection, and mechanical design.

58593 (NP—2902902) **IKO annual report, 1980.** (Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands)). 1980. 103p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82902902.

Research at IKO is described under the main headings: electron scattering, muon and hadron physics, nuclear theory, radio- and nuclear chemistry, accelerator technology, computer systems, and construction of the MEA electron linac. (WHK)

58594 (NP—2903252) **Annual report 1980. January 1980-December 1980.** (Tokyo Univ. (Japan). Inst. for Nuclear Study). 1980. 159p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE82903252.

Portions of document are illegible.

This annual report reviews research activities and technical developments carried out at the Institute for Nuclear Study (INS) during the period January-December 1980. Studies on the nuclear structures and the nuclear reactions have been continued by use of the SF cyclotron (K = 68). Studies on (α, ^{6}He) two-neutron transfer reactions in ^{92}Zr and ^{208}Pb targets have revealed a unique feature of the reaction to study two-nucleon correlations in nuclei because of the predominant configuration in ^{6}He. Utilization of the heavy-ion beams has been extended: In taking advantage of the high-energy beam of LI ions from the SF cyclotron, the ^{16}O(^{6}Li, d)^{20}Ne reaction has been studied in illustrating effectiveness of the α-transfer process to the study of collective states. High-spin states of ^{28}Si were studied by α-angular correlations in the ^{12}C(^{20}Ne, α)^{28}Si*(α)^{24}Mg reaction, and the 8^+ and 10^+ states hitherto unknown have been identified. At the High-Energy Physics Division, studies on photoreactions have been continued by use of the 1.3-GeV electron synchrotron: search for di-baryon resonances in the $\gamma d \rightarrow pn$ process has been extended by measuring the asymmetry on a polarized deuterium target and also by measuring the differential cross sections by use of the tagged-photon system. Measurements on momentum spectra of protons from photo-nuclear reactions on Be and C were extended in the angular range. Measurements on proton polarization on $\alpha p \rightarrow \pi^0 p$ and differential cross sections for $\gamma p \rightarrow \gamma p$ at backward angle have been continued. At the Study Group for the Numatron Project, further studies on beam dynamics have been progressed by use of the Tarn, the test accumulation ring for the Numatron project, in which the beam of particles accelerated by the SF cyclotron was injected and accumulated.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 57983, 58685

58595 (IAE—3409/14) **Problems of formation of neutron-optical image with the help of very slow neutrons.** Frank, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702711.

The prospects for development of neutron optical systems (NOS) with very slow (the energy < or approximately 10^{-5} eV) and ultracold (< or approximately 10^{-7} eV) neutrons are discussed. Nuclear lenses (prisms), mirrors, magnetic lenses and diffraction optical elements are considered as the most suitable ones to perform three-dimensional neutron focussing. In order to offset the effect of gravitation on the image quality, such means as diffraction compensation of chromatic abberration, magnetic compensation of gravitation and multi-mirror systems are proposed. The neutron microscope is concluded to be technically feasible. Low intensity of the present-day very slow neutron sources is pointed out as the most substantial obstacle in putting the idea into practice.

58596 (INIS-mf—7116, pp vp) **Recent developments in experimental determinations of gyromagnetic ratios of short-lived excited nuclear states.** Bolotin, H.H. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58597 (INIS-mf—7116, pp vp) **Use of tensor polarized deuterons to measure spin and parity.** Kuehner, J.A. (McMaster Univ., Hamilton, Ontario (Canada)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58598 (ITEF—46(1981)) **Equipment of fast reversing of polarization of the polarized thermal neutron beam.** Gul'ko, A.D.; Ermakov, O.N.; Karpikhin, I.L.; Krupchinskij, P.A.; Kuznetsov, Yu.Eh.; Perepelitsa, V.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702202.

The spin-flip switch which is a part of equipment of fast reversing of polarization of the polarized neutron beam is described. The spin-flip switch consists of the master oscillator, spin-flip shaper power units, exposure timer, control unit. Basic circuits of above units are given and their performance is described. The switch assures the performance of various configurations of magnetic elements by the pre-set program. The switch generates as well control signals for external facilities of data accumulation from the detectors and synchronizes their performance with reversing of polarization orientation. The results of combined performance of the spin-flip switch with a beam bending magnet and wire current shielding are presented. The dependence of the degree of polarization on neutron detection time and the time from the start of blocking of the input of accumulation devices up to the end of blocking is measured. It has been found that at times exceeding 20 ms the polarization reaches its maximum value.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 57910, 58606

58599 (INIS-mf—7116, pp vp) **Effects of meson exchange currents on the forward cross section for d(γ,p)n.** Jaus, W.; Woolcock, W.S. (Australian National Univ., Canberra. Dept. of Theoretical Physics:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58600 (INIS-mf—7146) **Production of polarized deuterons and study of the tensor potential in the elastic deuteron scattering.** Frick, R. (Muenchen Univ. (Germany, F.R.). Sektion Physik). 5 Mar 1980. 106p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82780720.

Thesis.

The aim of this thesis is the experimental determination of a tensor term in the optical potential for deuteron scattering. Starting from the lamb-shift principle a source of negative ions was developed which lies on a potential of up to 300 kV and yields beam of polarized H^- - e.g. D^- -ions for the injection into the tandemo for experiments with deuterons selectively a purely vector polarized one a purely tensor polarized beam is available. In the second part of this thesis the first measurements performed at the Munich accelerator with the polarized deuteron beam are presented. The author has studied the light, nondeformed nuclei with spin O: ^{4}He, ^{16}O, ^{36}Ar. For ^{4}He a very satisfactory description of all data in the framework of an optical model was found; not all so good agreement with the measured angular distributions could by obtained up to now for ^{16}O and ^{36}Ar, because the numerical analysis was constrained on the application of an only real tensor potential. The result of these analyses is a tensor potential strongly increasing with decreasing mass number. (orig./HSI).

58601 **Neutron-deuteron analyzing power measurements at 50 MeV. I. Backward angles.** Romero, J.L.; Ullmann, J.L.; Brady, F.P.; Carlson, J.D.; Fitzgerald, D.H.; Sagle, A.L.; Subramanian, T.S.; Zanelli, C.I.; King, N.S.P.; McNaughton, M.W.; Bonner, B.E. (Crocker Nuclear Laboratory and Department of Physics University of California, Davis, California 95616). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2214-2218(May 1982).

The analyzing power of polarized 50 MeV neutrons on deuterons has been measured for center-of-mass angles between 90° and 150°. The data, combined with forward angle measurements, are compared with recent p+d analyzing power measurements at 49.3 MeV and also with a three-body calculation at 46.3 MeV.

58602 **Differential cross section for the πi d→pp reaction from 80 to 417 MeV.** Boswell, J.; Altemus, R.; Minehart, R.; Orphanos, L.; Ziock, H.J.; Wadlinger, E.A. (University of Virginia, Charlottesville, Virginia 22901). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2540-2549(May 1982).

Differential cross sections were measured for the reaction, $\pi^+ d \rightarrow pp$, at seven energies, 80, 100, 140, 182, 230, 323, and 417 MeV. Sufficient data were taken for a 1% statistical uncertainty at eleven different angles for most of these energies. The elastic $\pi^+ p$ reaction was used to normalize the $\pi^+ d \rightarrow pp$ data. Legendre polynomial fits of the data are presented. The increased accuracy and energy of these data require an addition of a $\cos^6\theta^*$ term in the traditional low energy form of the differential cross section: $C(A+\cos^2\theta^*+B\cos^4\theta^*)$. The coefficients, A and B, are used to compare the present data with a survey of previous experiments and the theoretical work of Niskanen. Agreement is usually within uncertainties, but some disagreement remains even among recent experiments.

58603 **Deuteron spectrum in $np \rightarrow d(\pi\pi)^0$ at 1.46 GeV/c.** Hollas, C.L.; Newsom, C.R.; Riley, P.J.; Bonner, B.E.; Glass, G. (The University of Texas at Austin, Austin, Texas 78712). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2614-2618(May 1982).

Deuteron "missing mass" spectra have been measured at 1.46 GeV/c over the complete allowed phase space angular region for the $np \rightarrow d(\pi\pi)^0$ reaction. Strong enhancements, evidence for the Abashian-Booth-Crowe effect, are not observed near momenta corresponding to the two pion missing mass values. A total cross section of 28.5 +- 1.5 μb has been determined for this reaction.

58604 **Thermal neutron capture cross section of deuterium.** Jurney, E.T.; Bendt, P.J.; Browne, J.C. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2810-2811(May 1982).

We have measured the thermal neutron capture cross section of deuterium by direct observation of the prompt gamma ray.

58605 **Models of pion production and a quark model of the physics at short distance.** Kisslinger, L.S. (Carnegie-Mellon University, Pittsburgh, PA 15213). *AIP (American Institute of Physics) Conference Proceedings;* **79**: No. 1, 243-263(10 Mar 1982).

An isobar doorway treatment of the two-baryon plus core model is discussed, with sample results. Short distance properties of interacting hadrons are involved. A six-quark model for the short-range two-baryon current is presented, with application to electromagnetic interactions with deuteron targets and pion absorption.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 57910, 58600, 58604, 58605, 58663

58606 (BNL—31674) **Strangeness exchange reactions and hypernuclei.** Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 24p. (CONF-820745—1). NTIS, PC A02/MF A01. Order Number DE82020376.

From 2. LAMPF workshop; Los Alamos, NM, USA (19 Jul 1982).

Portions of document are illegible.

Recent progress in the spectroscopy of Λ and Σ hypernuclei is reviewed. Prospects for the production of doubly strange hypernuclei at a future kaon factory are assessed. It is suggested that the (K^-,K^+) reaction on a nuclear target may afford an optimal way of producing the H dibaryon, a stable six quark object with J/sup π/ = O^+, S = -2.

58607 (INIS-mf—7111) **Measurement of the vector analysing power of the reaction ^{19}F(p vector,α_0)^{16}O in the energy range Esub(p) = 0.45 MeV to 0.85 MeV and studies of the level scheme of the ^{20}Ne nucleus.** Traudt, O. (Mainz Univ. (Germany, F.R.). Fachbereich Physik). 15 Feb 1979. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780698.

Thesis.

The experimental study of the reaction ^{19}F(p,α_0)^{16}0 was extended by a determination of the analysing power for the reaction in the energy range 454 keV <= Esub(p) <= 849 keV of the incident protons at laboratory angles thetasub(L) = 20° until 160°. By averaging of the proton spin angular distributions of the unpolarized cross section were also obtained. The angular distributions of these two observables were fitted by legendre polynomials. The results is a nonneglectable contribution of direct reactions and a new determination of a part of energylevels in ^{20}Ne. (orig./HSI).

58608 (INIS-mf—7116, pp vp) **Particle-hole description of ^{18}O and ^{42}Ca.** Assafiri, Y. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58609 (INIS-mf—7116, pp vp) **4^- states of ^{12}C.** Barker, F.C. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58610 (INIS-mf—7116, pp vp) **Masses and level schemes for very neutron rich light nuclei.** Fifield, L.K.; Durell, J.L.; Hotchkis, M.A.C.; Leigh, J.R.; Ophel, T.R.; Weisser, D.C. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58611 (INIS-mf—7116, pp vp) **Photonuclear reactions in p-shell nuclei.** Jury, J.W. (Trent Univ., Peterborough, Ontario (Canada). Dept. of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58612 (INIS-mf—7116, pp vp) **Photoneutron production cross-section in ^{6}Li from threshold to 12 MeV.** Dytlewski, N.; Sherlock, S.; Siddiqui, S.; Thies, H.H. (Western Australia Univ., Nedlands. Dept. of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58613 (INIS-mf—7116, pp vp) **Widths of the 4^- states in ^{16}O as measured by the $^{13}(^6\text{Li},t)^{16}$O reaction.** Atwood, C.H.; Kemper, K.W.; Shute, G.G.; Fifield, L.K.; Ophel, T.R. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58614 (INIS-mf—7116, pp vp) **$^{13}\text{C}(\alpha,p)^{16}\text{N}$ reaction at 118 MeV.** Andrews, P.R. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58615 (INIS-mf—7116, pp vp) **Measurement of the $^7\text{Li}(\gamma,n)$ cross section.** Harty, P.D.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58616 (INIS-mf—7116, pp vp) **Angular distributions in the reaction $^6\text{Li}(p,\gamma)^7\text{Be}$ at low energies.** Tingwell, C.I.W.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58617 (INIS-mf—7116, pp vp) **Inelastic proton scattering from ^{13}C at 135 MeV.** Collins, S.F.; Shute, G.G.; Spicer, B.M.; Officer, V.C. (Melbourne Univ., Parkville (Australia). School of Physics); Devins, D.W.; Friesel, D.L.; Jones, W.P. (Indiana Univ., Bloomington (USA)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58618 (INIS-mf—7116, pp vp) **$^9\text{Be}(p,\pi^{+-})$ reactions at intermediate energies.** Auld, E.G.; Jones, G.; Lolos, G.J.; Mathie, E.L.; Walden, P.L. (British Columbia Univ., Vancouver (Canada)); Taylor, R.B. (James Cook Univ. of North Queensland, Townsville (Australia)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58619 (INIS-mf—7144) **$^{12}\text{C} + {}^{12}\text{C}$: 1. Decay into high spin states of ^{23}Mg, and ^{23}Na. 2. Hauser-Feshbach analysis of the reaction mechanism.** Denhoefer, G. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet Physik). 22 Apr 1980. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780719.

Thesis.

In this thesis different aspects of the reaction $^{12}\text{C} + {}^{12}\text{C}$ were studied. The first part deals with high spin states in the mirror nucki ^{23}Na and ^{23}Mg experially with the states resonantly populated at Esub(cm) = 19.3 MeV. For the state at 9.80 MeV in ^{23}Na with (p,γ) angular correlation measurements a spin of $17/2^+$ and by Doppler form analysis a lifetime of (21 +- 9)fs was found. The probably analogous state at 9.61 MeV in ^{23}Mg decays both under p-emission to ^{22}Na and under γ-emission. Because of the p-decay probabilities to 3^+ and 4^+ of ^{22}Na, which were observed in (p,n) coincidence measurements, it has also the spin $17/2^+$. In the second part of this thesis it was studied whether the reaction $^{12}\text{C} + {}^{12}\text{C}$ at incident energies between 26 MeV and 42 MeV can be described using the statistical model. (orig./HSI).

58620 (INIS-mf—7177) **Radiation capture of negative pions from the 1s-level in ^{6}Li.** Renker, D. (Muenchen Univ. (Germany, F.R.). Fachbereich Physik). 20 Feb 1981. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780723.

Thesis.

The author has measured the γ-spectra for the reaction $^6\text{Li}(\pi^-,\gamma)^6\text{He}$ at pion momenta of 200 and 220 MeV/c. From the γ-spectra branching ratios for the transitions to the ground state and the first excited state in ^{6}He are obtained. (HSI).

58621 (INIS-mf—7179) **Study of the resonance behaviour of the systems $^{12}\text{C} + {}^{12}\text{C}$ and $^{14}\text{C} + {}^{14}\text{C}$.** Trombik, W. (Muenchen Univ. (Germany, F.R.). Fachbereich Physik). 11 Dec 1980. 142p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780724.

Thesis.

In the present thesis the resonant behaviour of the elastic e.g. inelastic scattering of $^{12}\text{C} + {}^{12}\text{C}$ and $^{14}\text{C} + {}^{14}\text{C}$ is studied. For the system $^{12}\text{C} + {}^{12}\text{C}$ the spin alignment Psub(zz) of the inelastic scattering $^{12}\text{C}(^{12}\text{C},^{12}\text{C})^{12}\text{C}^*(2^+$, 4.43 MeV) at six energies between 18.5 and 32.8 MeV (c.m.) is determined. The measurement was performed by coincident detection of particles and γ-quanta, whereby the γ detector was oriented in the direction of the scattering norm. The obtained Psub(z)sub(z)-values fluctuate strongly at the maxima of the excitation function (from +0.03 to +0.84) as at the minima (from -0.04 to +0.76). This result agrees neither with the predictions of the band crossing model (Abe) nor with the expectations of non-resonant models. At $^{14}\text{C} + {}^{14}\text{C}$ the elastic scattering at Esub(c.m.) = 6-35 MeV as well as the single or double inelastic scattering to 3^-(6.73MeV) from 15 to 35 MeV (c.m.) was measured. In the elastic 90°(c.m.) excitation functions strongly pronounced crude structures (width 2-3 MeV (c.m.)) are shown, which are similar to the scattering behaviour of $^{16}0 + {}^{16}0$ and can be qualitatively described by surface transparent optical potentials. By measurements of the angular distributions it could be shown, that at the maxima of the excitation function at 15.5, 19.5, 24, and 28 the partial waves L = 12, 14, 17, e.g. 18 dominate. In the inelastic scattering from about 25 MeV (c.m.) clearly intermediate structures were observed, but the absolute value of the cross sections lies at about one order of magnitude below that of $^{12}\text{C}^* + {}^{12}\text{C}(2^+)$ e.g. $^{12}\text{C}^*(2^+) + {}^{12}\text{C}^*(2^+)$. This result as well as the only weak appearance of intermediate structures in the elastic scattering leads to the conclusion of a weak coupling between ground state and the 3^--state. (orig./HSI).

58622 (INIS-mf—7180) **Studies on the radiative capture of heavy ions at the Munich heavy ion recoil spectrometer.** Konrad, P. (Muenchen Univ. (Germany, F.R.). Fachbereich Physik). 19 Nov 1980. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780725.

Thesis.

The present thesis deals with the radiative heavy ion capture. Contrary to the capture of light ions to this only few and partly contradicting data exist. The used measuring methods partly allow only a nonsatisfying discrimination against the background from target impurities. The experiments were performed at the Munich tandem accelerator with the heavy ion recoil spectrometer which is optimally suited for measurements of this kind. It allows measurements at 0° relative to the beam direction and a complete identification of fusion products by nuclear charge, mass, and energy. With this it combines a high detection probability for these reactions with good discrimination possibility of disturbing reactions. At the reaction $^{16}O(^{32}S,^{48}Cr)\gamma$ at Esub(lab)(^{32}S) = 85 MeV no radiative capture could be observed. The found upper limit of sigmasub(γ) < 50 nb lies by more than 2 orders of magnitude below a cross section published for the same incident energy. The by oxygen impurities in the target less sensitive measurement of the reaction $^{14}N(^{30}Si,^{44}Sc)\gamma$ yielded sigmasub(γ) approx. <= 1 μb at Esub(lab)(^{30}Si) = 81.2 MeV. For this system also the radiative capture is much lower than published values. The experimental results are compatible with calculations using the compound-nucleus evaporation model, if for γ-transitions from the continuum the same reduced matrix elements are applied, as they are obtained from transitions between bound states in sd-shell nuclei in the mean. Collectively amplified transitions from the continuum which were suggested by some published high radiative capture cross sections do not occur in heavy ion reactions by these measurements. These statements are confirmed by recent results of other authors. (orig.).

58623 **(JINR-R—3-81-371) Spin dependence of S-wave neutron scattering cross section on ^{7}Li.** Alfimenkov, V.P.; Borzakov, S.B.; Vo Van Tkhuan; Mareev, Yu.D.; Pikel'ner, L.B.; Rubin, D.; Khrykin, A.S.; Sharapov, Eh.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702332.

The cross section for neutron scattering by ^{7}Li nuclei was measured at the IBR-30 reactor in the energy region up to 80 keV. In the experiment with polarized neutrons and polarized Li target there was determined the polarization cross section in the energy interval 2 eV-100 keV. Experimental results were analysed in the frame of the problem of existence of odd parity levels in ^{8}Li.

58624 **Excitation of low spin states in the $^{12}C(p,p')$ reaction at 800 MeV.** Haji-Saeid, M.; Igo, G.; Irom, F.; McClelland, J.B.; Pauletta, G.; Whitten, C.A. Jr.; Glashauser, C.; Cornelius, W.D.; Moss, J.M.; Thiessen, H.A.; Franey, M.A.; Gazzaly, M.; Love, W.G. (University of California, Los Angeles, California 90024). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 6, 3035-3042(Jun 1982).

Differential cross sections for the inelastic excitation of ^{12}C by protons have been measured at 0.8 GeV; the range of the angular distribution corresponds to momentum transfers of 0.7—2.4 fm^{-1} (1—3.3 m/sub π/). Data for the 1^{+}(T = 0), 1^{+}(T = 1), 2^{+}(T = 1), and the 2^{-}(T = 1) states at 12.71, 15.11, 16.11, and 16.58 MeV, respectively, have been obtained. These states, as well as the 2^{+}(T = 0) state at 4.44 MeV, provide a sensitive test of different parts of the effective N-N interaction at 0.8 GeV. We conclude that the differential cross sections for the ^{12}C excitations can be adequately described in the distorted-wave impulse approximation using a recently published t-matrix interaction.

58625 **Target mass dependence of isotensor double charge exchange: Evidence for deltas in nuclei.** Morris, C.L.; Fortune, H.T.; Bland, L.C.; Gilman, R.; Greene, S.J.; Cottingame, W.B.; Holtkamp, D.B.; Burleson, G.R.; Moore, C.F. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 6, 3218-3220(Jun 1982).

Measurements of forward-angle cross sections for double charge exchange on ^{16}O, ^{28}Si, and ^{40}Ca at 164 MeV incident pion energy suggest an A/sup -4/3/ dependence for the cross section. This A dependence is shown to provide evidence for Δ components in the nuclear wave function.

58626 **$^{7}Li(d,p)^{8}Li$ reaction cross section near 0.78 MeV.** Elwyn, A.J.; Holland, R.E.; Davids, C.N.; Ray, W. Jr. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2168-2173(May 1982). Contract W-31-109-ENG-38.

The total cross section for the $^{7}Li(d,p)^{8}Li$ reaction has been obtained at four energies near 0.78 MeV from measurements of the differential cross sections for the outgoing protons at laboratory angles between 20° and 155°. The average value, 146 +- 13 mb at an average deuteron energy of 0.781 MeV, is about 20% lower than the weighted mean of all previous absolute measurements. It is, however, in agreement with two other completely independent measurements, and the three experiments together provide a consistent (but lower) value for this important cross section.

58627 **Pion-nucleus inelastic scattering at 80 MeV.** Blecher, M.; Gotow, K.; Ng, R.; Burman, R.L.; Carlini, R.; Dam, S.; Hynes, M.V.; Leitch, M.J.; Sandberg, V.; Auble, R.; Bertrand, F.E.; Gross, E.E.; Obenshain, F.E.; Wu, J.; Blanpied, G.S.; Preedom, B.M.; Ritchie, B.G.; Bertozzi, W.; Kovash, M.A.; Redwine, R.P. (Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2554-2562(May 1982).

80 MeV positive and negative pions inelastically scattered from targets of ^{12}C and ^{40}Ca have been studied at laboratory angles between 50° and 120°. Angular distributions are presented for scattering from the 4.44 MeV (2^{+}) state in ^{12}C, the 3.7 MeV (3^{-}), 13.4 MeV, and 17.5 MeV states in ^{40}Ca. The cross sections are compared with distorted wave calculations using potentials obtained from elastic scattering.

58628 **Kaon scattering from C and Ca at 800 MeV/c.** Marlow, D.; Barnes, P.D.; Colella, N.J.; Dytman, S.A.; Eisenstein, R.A.; Grace, R.; Takeutchi, F.; Wharton, W.R.; Bart, S.; Hancock, D.; Hackenberg, R.; Hungerford, E.; Mayes, W.; Pinsky, L.; Williams, T.; Chrien, R.; Palevsky, H.; Sutter, R. (Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2619-2637(May 1982).

Results from K^{+-} elastic and inelastic scattering from ^{12}C and ^{40}Ca are reported. The data were all taken at an incident momentum of 800 MeV/c over an angular range from 2 to 38° . The elastic data are compared to first-order optical model calculations in coordinate and momentum space; good qualitative agreement is obtained. The inelastic data (from ^{12}C only) are compared to distorted-wave Born approximation calculations, and good agreement is found if "realistic" inelastic transition densities are used. Although a first-order optical potential description does not describe the data fully, there are strong indications of the increased penetrability of K^{+} over K^{-} in this energy range.

58629 **Overview of experimental trends and systematics in pion production and absorption in nuclei.** Hoeistad, B. (Physics Department, University of Texas at Austin, Austin, Texas 78712, USA). *AIP (American Institute of Physics) Conference Proceedings;* **79**: No. 1, 105-129(10 Mar 1982).

An experimental overview of the (p,π) reaction on nuclei is given, emphasizing systematic behaviour in the data in general. Specific features in the data which point to nuclear structure dependence as well as in influence from the reaction dynamics are also discussed.

58630 **Pion production by target emission.** Gibbs, W.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* **79**: No. 1, 297-317(10 Mar 1982). (CONF-8110152—).

From AIP conference on pion production and absorption in nuclei; Bloomington, IN, USA (22 Oct 1981).

The coherent production of pions in a proton nucleus collision is calculated. The energy region considered is below the nucleon-nucleon threshold so that the entire nucleus must take part in the process. The amplitude for this reaction is broken into two parts, the first part being characterized by initial emission of the pion from the projectile and the second part by initial emission from the target nucleus. It is the second part which is emphasized in this talk. The target nuclei ^{12}C and ^{209}Bi are considered. Total production cross sections as a function of energy and some angular distributions are calculated.

58631 **Resonances in heavy-ion collisions: experimental status.** Henning, W. (Argonne National Lab., IL). pp 75-99 of Dynamics of heavy-ion collisions. Cindro, N.; Ricci, R.A.; Greiner, W. (eds.). Amsterdam, Netherlands; North-Holland Publishing Company (1981). Contract W-31-109-ENG-38.

Experimental results are presented for studies of resonances in heavy-ion collision systems. Signatures of resonances, as observed in total reaction and total fusion cross sections, in elastic and inelastic scattering and in transfer reactions are discussed. Some selected examples are given for the extraction of resonance parameters and problems associated with such attempts. Emphasis is placed on recent results which indicate that resonance phenomena are observed in heavy-ion systems with compound nuclei extending well into the f-p shell.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 58600, 58607, 58625, 58631, 58663, 58694

58632 **(AD-A—111573/2) Recoil distributions in some proton reactions. Memorandum report.** Langworthy, J.B. (Naval Research Lab., Washington, DC (USA)). 29 Jan 1982. 19p. (NRL-MR—4731). NTIS, PC A02/MF A01.

The distributions of recoil products from the two most important double decays of silicon excited by proton absorption are calculated by analytical and numerical methods. The nuclear reactions treated are Si(p, p alpha) and Si(p, 2p) and it is assumed the decays are by evaporation. Conversion of the results to distributions of dose is discussed. The latter distributions are of interest in the soft upset of satellite electronic memories.

58633 **(CEA-N—1466(Pt.6)) Cross sections of nuclear reactions induced by protons, deuterons, and alpha particles. Pt.6. Phosphorus.** Tobailem, Jacques. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Electronique Physique). Nov 1981. 27p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702322.

Cross sections are reviewed for nuclear reactions induced by protons, deuterons, and alpha particles on phosphorus targets. When necessary, published experimental data are corrected, and, when possible, excitation functions are proposed.

58634 **(DOE/ER/40048—14L2) ^{26}Al/sup g,m/ production cross sections from the ^{23}Na(α,n)^{26}Al reaction.** Norman, E.B.; Chupp, T.E.; Lesko, K.T.; Schwalbach, P.; Grant, P.J. (Washington Univ., Seattle (USA)). 1981. Contract AC06-81ER40048. 24p. NTIS, PC A02/MF A01. Order Number DE82020145.

Cross sections have been determined for the production of ^{26}Al/sup g,m/ from the ^{23}Na(α,n) reaction. Total ^{26}Al production cross sections were obtained from measurements of the thick-target neutron yield. ^{26}Al/sup m/ cross sections were measured using an activation technique. ^{26}Al/sup g/ cross sections were deduced by subtracting the ^{26}Al/sup m/ cross sections from the total (α,n) cross sections. The principle of detailed balance has been applied to the low energy data to obtain cross sections for the astrophysically interesting ^{26}Al/sup g/(n,α_0)^{23}Na reaction. These results are compared with the results of Hauser-Feshbach calculations.

58635 **(EFI—291(16)-78) Hole excitations of the ^{31}P nucleus.** Kocharova, Zh.L. (Erevanskij Fizicheskij Inst. (USSR)). 1978. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702310.

The analysis of the available data on spectroscopic information about hole excitation of ^{31}P nucleus is carried out. The data are obtained from two types of experiments: 1) from pick-up reactions (such as (p,α), (α,^{3}He), (^{3}He,α)); 2) from quasielastic knock-on reactions (e,e'p) and (p,2p). This two types of experiments give in a number of cases various energy positions of hole states. The advantages and deficiences of each type of those experiments were discussed and possible reasons of disagreements were indicated. The interpretation of the ground and low-lying excited states of ^{31}P nucleus is given from the comparison of theoretical and experimental data on spectroscopic characteristics of ^{31}P nucleus levels.

58636 (INIS-mf—7116, pp vp) **Recoil distance lifetime measurements in ^{30}Si using a particle-gamma technique.** Bhalla, R.K.; Poletti, A.R. (Auckland Univ. (New Zealand). Dept. of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58637 (INIS-mf—7116, pp vp) **Photoproton cross sections for ^{25}Mg and ^{26}Si in the giant dipole region.** Sutton, R.A.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58638 (INIS-mf—7116, pp vp) **^{25}Mg(α,n)^{28}Si and ^{26}Mg(α,n)^{29}Si as neutron sources in neon burning.** Anderson, M.R.; Mitchell, L.W.; Sevior, M.E.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58639 (INIS-mf—7116, pp vp) **Electric moments of the first excited state of ^{32}S.** Vermeer, W.J.; Esat, M.T.; Spear, R.H. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58640 (INIS-mf—7116, pp vp) **Inelastic scattering of O^{16} from Mg^{24}.** Nurzynski, J.; Atwood, C.H.; Ophel, T.R.; Hebbard, D.F. (Australian National Univ., Canberra. Dept. of Nuclear Physics); Robson, B.A.; Smith, R. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58641 **(INIS-mf—7181) Study of ^{16}O-induced deep inelastic nuclear reactions on ^{27}Al, ^{48}Ti, and ^{58}Ni by spectroscopy of the gamma radiation from the reaction products.** Puchta, H. (Muenchen Univ. (Germany, F.R.). Fachbereich Physik). 25 Feb 1980. 151p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82780726.

Thesis.

The present thesis deals with the spectroscopy of the gamma radiation from the reaction fragments after binary reactions in the systems ^{16}O + ^{27}Al, ^{48}Ti, and ^{58}Ni at incident energies from 90 to 100 MeV, i.e. far above the Coulomb threshold. ΔE-E telescopes, which were located at 35° to the beam direction, detected the projectile-like fragments and defined the reaction channel and the scattering plane. In coincidence to this the gamma quanta in a 120-cm^3-Ge(Li)-diode and a 27 x 33-cm-NaI-spectrometer were observed. The gamma spectra are equal to those observed hitherto in fusion reactions except for the high energetic gamma lines from the ejectiles, which are raised from the gamma continuum of the heavy fragments. From the spectroscoped gamma radiation for the light as for the heavy fragments the excitation energy, the value of the fragment angular momentum, as well as the occupation of the magnetic sublevels could be determined. The hard projectile ^{16}O transfers the dissipated energy and the angular momentum transferred by the spin of the fragments nearly completely into the residue nucleus. The probability for the observation of a ground state transition in one of the heavy fragments extends to (0.85 +- 0.10) per carbon ejectile in the system ^{16}O + ^{48}Ti. The residue nucleus distribution corresponds to that expected by the statistical model from the decay of the compound-nucleus ^{52}Cr belonging to the ejectile ^{12}C, the excitation energy of which corresponds to the reaction Q-value. (orig./HSI).

58642 **Measurement of "subthreshold" production of K^- and antiprotons in relativistic nuclear collisions.** Shor, A.; Ganezer, K.; Abachi, S.; Carroll, J.; Geaga, J.; Igo, G.; Lindstrom, P.; Mulera, T.; Perez-Mendez, V.; Sagle, A.; Woodard, D.; Zarbakhsh, F. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **48**: No. 23, 1597-1600(7 Jun 1982). Contract AC03-76SF00098;AM03-76SF00010.

The observation of subthreshold production of K^- in the reaction $^{28}Si+^{28}Si$ at 2.1 GeV/nucleon is reported. For production at O^0 and 1 GeV/c, a K^- cross section ($d^2\sigma/dp\ d\Omega$) of 1.6 mb sr^{-1} $(GeV/c)^{-1}$ and an upper limit for p-bar production of 3 nb sr^{-1} $(GeV/c)^{-1}$ were measured. Calculations incorporating the effects of nuclear Fermi momentum underpredict the K^- yield by more than a factor of 20. Production mechanisms involving collective effects and equilibration are discussed.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 57983, 58532, 58608, 58625, 58628, 58631, 58641

58643 (INIS-mf—7112) **Integral excitation functions for proton and alpha induced reactions on target elements 22 <= Z <= 28.** Brinkmann, G. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 15 Dec 1979. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780699.

Thesis.

In the framework of a systematic study which is also important for certain cosmological questions a series of integral excitation functions of p- and α-induced nuclear reactions on target elements 22 <= Z <= 28 were determined using the stacked-foil technique. The irradiations were performed at the isochronous cyclotron Julic as well as the compact cyclotron CV 28 of the nuclear research establishment Juelich. Basing on earlier work which was limited on protons with energies between 12 and 45 MeV the energy range from 3 to 17 MeV was also studied. Hereby 17 excitation functions for the target elements Ti, V, Fe, Co and Ni could be determined. The measured sigma values correspond to the behaviour expected from earlier studies and confirm furthermore the observations of that time concerning considerable contributions by complex particles in the low energy range.

58644 (INIS-mf—7116, pp vp) **Gneuss-Greiner model approach to calcium isotopes.** Weise, J.I. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58645 (INIS-mf—7116, pp vp) **Effective charges from (p,p') analyses.** McLeod, I.; Amos, K. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58646 (INIS-mf—7116, pp vp) **Thermonuclear reaction rates and the mass 45 bottleneck.** Mitchell, L.W.; Anderson, M.R.; Kennett, S.R.; Sevior, M.E.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58647 (INIS-mf—7116, pp vp) **Neutron capture gamma-ray research with GELINA.** Allen, B.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Applied Physics Div.). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58648 (INIS-mf—7116, pp vp) **Thermonuclear reaction rates for neutron induced reactions on ^{41}Ca.** Sevior, M.E.; Anderson, M.R.; Mitchell, L.W.; Kennett, S.R.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58649 (INIS-mf—7116, pp vp) **Shell model calculations and two step reaction processes in the $^{40}Ca(d,^3He)^{39}K$ reaction.** Chan, F. (Melbourne Univ., Parkville (Australia)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58650 (INIS-mf—7116, pp vp) **$^{40}Ca(p,pn)^{39}Ca$ and $^{48}Ca(p,pn)^{47}Ca$ reactions at 150 MeV.** Watson, J.W.; Ahmad, M.; Madey, R. (Kent State Univ., OH (USA)); Flanders, B.S.; Friesel, D. (Indiana Univ., Bloomington (USA)); Chant, N.S.; Roos, P.G. (Maryland Univ., Baltimore (USA)); Wastell, J.M.R. (Melbourne Univ., Parkville (Australia)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58651 **(JINR-R—1-81-258) Search for decays of superdense nuclei in a two-meter propane chamber.** Abdivaliev, A.; Zubarev, A.N.; Korzhev, N.A.; Kochurov, A.G.; Nikitin, A.V.; Pechenov, V.N.; Smirnov, N.A.; Sokolov, V.P.; Solov'ev, M.I.; Troyan, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702331.

The upper limits of the cross sections for productions of superdense nuclei are determined on the level of $5x10^{-33}$-10^{-28} cm^2 at irradiating $_{28}Ni^{58}$, $_{82}Pb^{208}$, $_{29}Cu^{63}$, $_{73}Ta^{181}$, targets with $_6C^{12}$ protons with 1.90; 3.36; 9.80 GeV/c momenta; with α particles of 0.95 GeV/c nucleon momentum, with carbon nuclei of 3.36 GeV/c nucleon momentum. Positron spectra from the decay of superdense nuclei are given. Estimations of the probability of superdense nuclei decays are presented.

58652 **Light-ion emission in heavy-ion collisions: Beam energy dependence.** Auble, R.L.; Ball, J.B.; Bertrand, F.E.; Ferguson, R.L.; Fulmer, C.B.; Lee, I.Y.; Robinson, R.L.; Young, G.R.; Wu, J.R.; Wells, J.C.; Yamada, H. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 5, 2504-2511(May 1982). Contract W-7405-ENG-26.

Light ions with Z = 1, 2 and velocities greater than the beam velocity, produced in collisions between carbon and nickel nuclei, are studied using ^{12}C beams with energies between 7.5 and 16 MeV per nucleon. Energy spectra and angular distributions are reported and excitation functions derived from these data are presented. Integral cross sections for protons with velocities greater than the beam velocity are found to be insensitive to the beam energy. A model in which particles are emitted by an excited source, moving with a velocity approximately one-half that of the beam, is found to be capable of reproducing most of the data.

58653 **Large angle elastic and inelastic scattering of protons from ^{40}Ca at 800 MeV.** Bleszynski, E.; Bleszynski, M.; Hajisaeid, S.; Igo, G.J.; Irom, F.; McClelland, J.B.; Pauletta, C.; Rahbar, A.; Wang, A.T.M.; Whitten, C.A. Jr.; Adams, G.; Barlett, M.; Hoffmann, G.W.; McGill, J.A.; Boudrie, R.; Kyle, G. (University of California, Los Angeles, California 90024). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 5, 2563-2573(May 1982).

Measurements are reported for the elastic and inelastic scattering of 800 MeV protons from ^{40}Ca. Differential cross sections were measured out to 42° while analyzing powers were obtained out to 30°. The angular distributions are diffractive in character at all angles. Theoretical analysis of the data was carried out in the framework of the diffraction multiple scattering theory. The following results were obtained: (i) Diffraction multiple scattering theory reproduces the data qualitatively out to the large momentum transfers. (ii) For the ground state density distribution <r/sub p/ ²>/sup 1/2/-<r/sub n/ ²>/sup 1/2/ = 0.142 +- 0.075 fm is obtained and the analysis favors the value of the correlation length ξ/ sub c/ = -0.5 fm. (iii) The excitation of the lowest-lying collective states (3^-, 5^-, 2^+) was analyzed using one-phonon excitation macroscopic parameters. The values of the β_2, β_3, β_5 parameters obtained agree quantitatively with lower energy (p,p′) scattering results.

58654 **Elastic scattering of πi and π^- from ^{40}Ca at 64.8 MeV.** Dam, S.H.; Edge, R.D.; Preedom, B.M.; Hamm, M.; Burman, R.L.; Carlini, R.; Redwine, R.P.; Yates, M.A.; Blecher, M.; Gotow, K.; Bertrand, F.E.; Gross, E.E.; Moinester, M.A. (University of South Carolina, Columbia, South Carolina 29208). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 5, 2574-2582(May 1982).

Angular distributions of π^+ and π^- elastic scattering on ^{40}Ca at 64.8 MeV are presented. The data are analyzed using a first-order, nonlocal optical model based on a Kisslinger t matrix with an off-shell form factor. This model is unable to fit the data for any value of the off-shell parameter α unless the nuclear matter radius is allowed to vary from that derived from electron scattering. The resulting best-fit radii are as much as 0.40 fm larger than the electron scattering value for π^+ and 0.55 fm larger for π^-. For a given α the π^- best fit radius is also consistently larger by about 0.2 fm than that for π^+. In addition, the fits show no significant preference for any value of α between 400 and 900 MeV/c. Inclusion of the normally omitted second-order potential terms in the optical model does not significantly alter the results.

58655 **Spin-orbit deformations deduced from analyzing powers for inelastic neutron scattering from ^{54}Fe, ^{56}Fe, ^{58}Ni, ^{60}Ni, ^{120}Sn, and ^{208}Pb.** Guss, P.P.; Floyd, C.E.; Murphy, K.; Howell, C.R.; Pedroni, R.S.; Honore, G.M.; Pfutzner, H.G.; Tungate, G.; Byrd, R.C.; Walter, R.L.; Delaroche, J.P. (Department of Physics, Duke University, Durham, North Carolina 27706). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 5, 2854-2857(May 1982).

Analyzing powers A/sub y/(θ) for inelastic scattering of 10-MeV neutrons to the first excited states of ^{54}Fe, ^{56}Fe, ^{58}Ni, ^{60}Ni, ^{120}Sn, and ^{208}Pb have been measured at a few selected angles. These data were analyzed using a coupled channels code in which the full Thomas form of the spin-orbit potential is assumed. The magnitudes of the observed spin-orbit deformations, which were found to be similar to those for (p,p′) in each case, contradict recent suggestions based on microscopic nuclear structure considerations.

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 57910, 58445, 58643, 58647, 58651, 58655

58656 **(EFI—476(19)-81) Charge distributions of prodUcts from the spallation of intermediate mass nuclei by photons in Esub(γsub(max)) <= 4,5 GeV.** Grigoryan, E.O.; Demekhina, N.A. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702325.

Charge distributions of the residual nuclei produced in the process of the medium-weight target spallation in the mass region 51<=A<=93 by Esub(γsub(max))<=4.5 GeV photons of bremsstrahlung spectrum are investigated. The study of the characteristics of the charge distribution curves, the comparison with the data of hadron-nucleus reactions allowed to clear up some regularities of the residual nuclei production conditioned by their nucleon composition, to predict the probability of the unmeasured product yields. The character and properties of isobaric and mass distribution of the yields have been discussed as compared with the cascade-evaporation model calculations.

58657 **(INIS-mf—7176) Coulomb-nuclear force interference in the system ^{32}S + ^{60}Ni. Experiments and semiclassical analysis.** Dannhaeuser, G. (Muenchen Univ. (Germany, F.R.). Fachbereich Physik). 14 Jul 1980. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780722.

Thesis.

For the reaction ^{60}Ni(^{32}S,^{32}S*)^{60}Ni* using particle-γ-coincidences the excitation functions of ^{32}S($2^+{}_1$) and ^{60}Ni($2^+{}_1$) for projectile energies of 70-100 MeV as well as with Si single counters the angular distribution of the elastically and inelastically scattered ^{32}S ions for incident energies of 90, 95, and 100 MeV were measured. A comparison of the measurements with the results of different computer codes led to following results: 1.) At the determination of the static quadrupole moment Q_2 of ^{32}S using the reorientation effect the influence of the nuclear force can be neglected for projectile energies Esub(P) <= 72 MeV. 2.) For the static quadrupole moment of ^{32}S the value Q_2 = -0.18 +- 0.04 eb was found. (Hereby destructive interference with the virtual excitation of the $2^+{}_2$-state is assumed). 3.) For projectile energies Esub(P) >= 72 MeV at which the excitation by nuclear forces was small against the Coulomb excitation, an evaluation of the excitation function of ^{32}S($2^+{}_1$) by the semiclassical code NCL, which regards the influence of the nuclear interaction approximatively, yielded values for the static quadrupole moment, which agree within the measurement errors with the above value. 4.) For the quantitative analysis of the measured angular distributions a quantum mechanical CC-code was required. 5.) Using the semiclassical CC-code NCL an illustrative and detailed interpretation of the excitation functions of ^{32}S($2^+{}_1$) and ^{60}Ni($2^+{}_1$) could be given. 6.) The code NCL allows the study of the influence of the Coulomb-nuclear force interference on the temporal behaviour of the excitation process. 7.) Using the code NCL the angular distribution of the decay γ quanta for a fixed particle-scattering angle theta approx. <= 180° in dependence on the incident energy was calculated. (orig.).

58658 **(INIS-mf—7189) Structure of collective bands in ^{78}Kr.** Hellmeister, H.P. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 13 Dec 1980. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780728.

Thesis.

Using ^{16}O, ^{19}F, and ^{12}C induced reactions high spin states in ^{78}Kr were excited. The targets consisted of ^{65}Cu, ^{58}Ni, and ^{68}Zn. On the base of gamma spectroscopic methods as γγ-coincidences, angular distributions and excitation functions a level scheme of ^{78}Kr is proposed. Four bands could be identified, which decay mostly by stretched E2-transitions. From recoil distance Doppler shift as well as Doppler shift attenuation measurements lifetimes of about 20 states were measured. The β-decay of the 103 keV isomeric state and the ground state in ^{78}Rb was observed and the halflifes determined. Altogether a very good agreement of the level scheme and the E2- and E1-transition strength with predictions of the interacting boson model were found. Using a Monte Carlo code the γ-decay of the continuum of highly excited nuclei is described. Entry states, mean γ-energies, γ-spectra, mean multiplicities, multipolarities, and mean feeding times as well as e.g. their second moments were calculated for the reactions ^{58}Ni(^{16}O,2p)^{72}Se and ^{68}Zn(^{12}C,2n)^{78}Kr. The results are discussed and compared with experimental data. (HSI).

58659 **Two-quasiparticle-plus-rotor model calculations of /sup 76,78,80/Kr.** Soundranayagam, R.; Ramavataram, S.; Ramayya, A.V.; Hamilton, J.H.; Robinson, R.L. (Physics Department, Vanderbilt University, Nashville, Tennessee 37235). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 6, 2983-2989(Jun 1982).

Two-quasiparticle-plus-rotor model calculations have been performed for /sup 76,78.80/Kr to study the systematics of high-spin states of these nuclei. The negative parity states whose energies are well reproduced by the model are characterized as two-quasiproton states. The consistency of the parameters and the agreement of the experimental and theoretical levels support the tentative spin-parity assignments. Our results for ^{80}Kr positive-parity, high-spin states indicate that these are zero- and two-quasiproton mixed states.

58660 **^{59}Ni(n,γ) reaction with thermal neutrons.** Raman, S. (Oak Ridge National Lab., TN); Jurney, E.T. pp 728-730 of Neutron capture gamma-ray spectroscopy. Chrien, R.E.; Kane, W.R. (eds.). New York, NY; Plenum Publishing Corporation (1979). Contract W-7405-ENG-26.

We have investigated in great detail, at the Los Alamos thermal neutron capture γ-ray facility, the energy levels of ^{60}Ni populated in the ^{59}Ni(n,γ) reaction. The target consisted of ≃ 7 mg of metal enriched to 95% in ^{59}Ni. Using a Ge(Li) detector, over 250 γ rays were identified, some with intensities as low as 0.02 photons/100 n-captures. Over 210 γ rays have been incorporated into a ^{60}Ni level scheme with 72 excited states. The first 50 levels in ^{60}Ni based on our study are given.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 58445, 58597, 58597, 58647, 58655, 58683, 58715, 58735, 58741

58661 (ECN—108) **Evaluation of neutron cross sections for the Pd isotopes (RCN-3 data library).** van der Kamp, H.A.J.; Gruppelaar, H. (Netherlands Energy Research Foundation, Petten). Dec 1981. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82702300.

The evaluation procedure to obtain neutron cross sections of ^{102}Pd, ^{104}Pd, ^{105}Pd, ^{106}Pd, ^{107}Pd, ^{108}Pd and ^{110}Pd for inclusion in the RCN-3 data library of fission-product cross sections is described. The new evaluation takes into account the results of recent differential and integral data. Most of the adopted resolved resonance parameters have been taken from the new CBNM measurements; for ^{107}Pd the recent RPI data have been used. These resolved resonance parameters have been extensively analysed to obtain average values for the level spacing, capture width and neutron s- and p-wave strength functions. The systematics of the single-particle level-density parameter a and the capture width show significant odd-even effects. Optical-model and statistical-model calculations have been performed to obtain cross sections of reactions at energies from 1 meV to 15 MeV. The results for the capture cross sections based upon the analysed average resonance parameters turned out to be systematically lower than the ORELA average capture data and also lower than indicated by the most integral STEK data (except for ^{105}Pd). As a compromise we have performed adjustments to increase the calculated fast capture cross sections for ^{104}Pd, ^{106}Pd and ^{108}Pd.

58662 (ECN—111) **Cross-section library DOSCROS81 (in a 640 group structure of the SAND-II type).** Zijp, W.L.; Nolthenius, H.J.; Rieffe, H.Ch. (Netherlands Energy Research Foundation, Petten). Dec 1981. 93p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82702323.

The cross section library DOSCROS81 is an updated and extended version of the dosimetry cross section library DOSCROS77. The library contains energy dependent fine group cross section values for a number of reactions which are applied in neutron metrology and in neutron activation spectrometry. The library contains data from the ENDF/B-V file supplemented with information from the ENDF/B-IV and from the INDL/V. The total number of reaction cross section sets incorporated in this library is 70 (+ 3 cover cross section sets). A documentation of the library is presented. The library is written in the SAND-II format. The numerical data are available on microfiche upon request to ECN. The library will be available in a computer compatible form from the OECD NEA Data Bank and from the RSIC at Oak Ridge.

58663 (EFI—471(14)-81) **A-dependence of cumulative photoprotons.** Alankyan, K.V.; Amaryan, M.Dzh.; Demirchyan, R.A.; Egiyan, K.Sh.; Ogandzhanyan, M.S.; Stepanyan, S.G.; Sharabyan, Yu.G. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702324.

New experimental data on the A-dependence of the yield of proton photoproduction on nuclei in cumulative as well as non-cumulative regions are presented. It is shown that if the reaction yield has the form f approximately Asup(n) the exponent n is the slowly varying function of the proton kinetic energy without any peculiarities observed in the case of π-meson photoproduction. The dependences n on the proton detection angle and primary γ-quantum energy in the interval (Esub(γ))sub(max) 0.25-4.5 GeV are presented as well.

58664 (EFI—481(24)-81) **Cumulative photoproduction of particles on nuclei.** Egiyan, K.Sh. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702326.

A brief review is given of experimental investigations on the cumulative photoproduction of different particles in the interactions of high-energy γ-quanta with nuclei. Basing on the available data a conclusion is reached that in processes of the cumulative particle inclusive photoproduction the hypothesis of cumulative effect and nuclear scaling in electromagnetic interactions with nuclei are on the whole confirmed.

58665 (IAEA-NDS—42/R) **International Reactor Dosimetry File (IRDF-82).** Cullen, D.E.; Kocherov, N.; McLaughlin, P.M. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Jan 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702327.

This document describes the contents of the first version of the International Reactor Dosimetry File (IRDF-82), distributed by the Nuclear Data Section of the International Atomic Energy Agency. This document is a brief summary of the IRDF-82 documentation contained in IAEA-NDS-41.

58666 (INIS-mf—7116, pp vp) **Inelastic scattering and the structure of light deformed nuclei.** Smith, R.; Schmid, K.W. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58667 (INIS-mf—7116, pp vp) **Octupole vibrations in the even-mass barium isotopes.** Pribac, F.; Baxter, A.M.; Hinds, S. (Australian National Univ., Canberra. Dept. of Physics); Esat, M.T.; Spear, R.H. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58668 (INP—1094/PL) **Computer simulation of nuclear experiment with the ^{8}Be nucleus detection.** Kozik, T.; Czabanski, R. (Institute of Nuclear Physics, Krakow (Poland)). 1980. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702312.

The two-step nuclear reaction with a strong resonance in the outgoing channel is taken as an example of detailed modeling of the density of final states in the phase space. The practical method of the precise calculating the effective solid angle and effective energy spectrum from the coincident registration of products of reaction is developed. There is applied the modyfied Monte Carlo approach.

58669 (INS-J—161) **Quasi-ground, quasi-beta, and quasi-gamma bands.** Sakai, M. (Tokyo Univ. (Japan). Inst. for Nuclear Study). 13 Aug 1981. 45p. NTIS (MF) (US Sales Only). Order Number DE82904633.

Portions of document are illegible.

For even-even nuclei a list is presented of the probable members of quasi-ground, quasi-beta, and quasi-gamma bands of the spherical regions and the corresponding ground, beta, and gamma bands of the deformed regions. For simplicity the term quasi is used for both regions. References are given to the experimental data basic to the level assignments. The literature has been covered through January 1981.

58670 (ITEF—76(1980)) **Analysis of angular dependences of inclusive cross sections of proton and light ion production on nuclei in the region of limiting target fragmentation.** Bayukov, Yu.D.; Gavrilov, V.B.; Efremenko, V.I.; Zajtsev, Yu.M.; Leksin, G.A.; Stavinskij, A.V.; Suchkov, D.A.; Chistilin, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702329.

Inclusive angular distributions of protons and light ions in deep inelastic nuclear reactions are compared with different model predictions. A simple unified parametric description of all inclusive invariant cross sections studied is proposed. The variable X=P-T cos THETA, where P and T are impulse and kinetic energy of a secondary particle excaping from the nucleus at the THETA given angle is introduced. The X value enables with a good accuracy to give a common description of all experimental data in a wide range of varialbes.

58671 (JINR—E-1-81-578) Energy-dependence of the proton emission and pion production intensity distribution in pion-xenon nucleus collisions. Strugalski, Z.; Pawlak, T.; Peryt, W.; Miller, K.; Pluta, J.; Wosinska, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702715.

Distributions of the pion production and proton em+ssion intensities in the pion-xenon nucleus collisions at 2.34-8 GeV/c momenta are presented. The pions of any electric charge-negative, positive and neutral-were registered. Correlations between the emitted proton multiplicities nsub(p) and produced pion multiplicities nsub(π) were studied. Noticeable change in the shape of the correlation characteristics is observed with the projectile energy increasing. The produced pion average multiplicity <nsub(π)> is energy and nsub(p) dependent. The normalized dispersion <D>/<nsub(π)> is nsub(p) dependent as well; the nsub(p) dependence of the <D>/<nsub(π)> in the collision events at 2.34 and 3.5 GeV/c momentum differs from those at higher projectile momenta where they are momentum independent. The average multiplication of produced pions in dependence on the projectile energy is presented too. Information about the momentum dependence of the frequency of events without the pion production is given.

58672 (JINR—E-15-81-270) Negative pion capture in atomic nuclei near the closed neutron shell at N=82. Butsev, V.S.; Chultem, D.; Zhivotov, I.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702330.

The results of studies of the excitation of high spin states in stopped π^--absorption in Nd, Pr, Ce, La and Ba nuclei are reported. States with spins 7^-, 8^- and $19/2^-$ have been identified. The isomeric ratios for the isotopes ^{131}Ba and ^{133}Ba have been determined to be equal to σsub(m)/σsub(g)=(5.1+-0.5) and (2.2+-0.3), respectively. For the isomers sup(134m)Cs and sup(135m)Cs the isotopic ratio is found to be σsub(msub(1))/σsub(msub(2))=8.2+-2.3. The distinguishing features of the mechanisms of excitation of high spin states by stopped π^- and fast protons are discussed.

58673 (JINR-R—6-81-565) Properties of ^{135}La excited states. Budzynski, M.; Lebedev, N.A.; Lizurej, G.I.; Muminov, T.M.; Nazmitdinov, R.G.; Sarzhinski, Ya.; Khazratov, T.; Khalikulov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702333.

Angular correlations in ^{135}La have been measured for γ-cascades: 577-206, 666-206, 518-265, 607-265, 718-265, 905-265, 1184-265, 572-(34.5)-265, 871-(34.5)- 265, 1149-(34.5)-265 keV. The level spins of 1449 and 984 keV are determined as $1/2^+$. M1 and E2 multipolarities of some gamma-transitions are determined or refined. Properties of excited states in ^{135}La are investigated within the framework of the quasiparticle-phonon model with account for the Pauli principle. Calculations of reduced B(M1) and B(E2) probabilities for some ^{135}La transitions are given.

58674 (UCRL—85437) Exact calculations of nuclear-recoil energies from prompt gamma decays resulting from neutron capture. Kinney, J.H. (Lawrence Livermore National Lab., CA (USA)). 20 Jul 1981. Contract W-7405-ENG-48. 6p. (CONF-810831—92). NTIS, PC A02/MF A01. Order Number DE82019102.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Portions of document are illegible.

The results of an accurate determination of the recoil spectrum from (n, γ) reactions in molybdenum are presented. The recoil spectrum has been calculated from nuclear level structure data and measured branching ratios. Angular correlations between successive gammas have been accounted for using the standard theoretical techniques of Racah algebra and the density matrix formalism.

58675 Neutron separation energies of some heavy nuclides. Islam, M.A.; Kennett, T.J.; Prestwich, W.V. (Department of Physics, McMaster University, Hamilton, Ontario, Canada, L8S 4K1). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 6, 3184-3188(Jun 1982).

Precision mesurements of high energy γ rays from thermal (n,γ) reactions with twelve nuclides as targets have been performed with an energy scale based upon the neutron separation energy of ^{15}N. The final nuclides and the deduced neutron separation energies (in keV) with absolute errors are ^{143}Nd (6123.62 +- 0.13), ^{144}Nd (7817.11 +- 0.12), ^{146}Nd (7565.28 +- 0.14), ^{156}Gd (8536.39 +- 0.12), ^{158}Gd (7937.39 +- 0.12), ^{162}Dy (8196.99 +- 0.12), ^{163}Dy (6270.98 +- 0.11), ^{164}Dy (7658.11 +- 0.12), ^{165}Dy (5715.96 +- 0.11), ^{166}Ho (6243.69 +- 0.11), ^{174}Yb (7464.63 +- 0.11), and ^{175}Yb (5822.35 +- 0.12).

58676 Influence of the M1 tensor term for transitions between levels of the two-proton nucleus ^{134}Te populated in the beta decay of 10-s ^{134}Sb. Heyde, K.; Sau, J.; Henry, E.A.; Meyer, R.A. (Institute of Nuclear Physics, Proeftuinstraat 86, B-900 Gent, Belgium). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 6, 3193-3196(Jun 1982).

Detailed calculations of electromagnetic transition rates (E2, M1, M2) have been carried out for ^{134}Te and compared with the results of detailed measurements on the gamma decay properties of this nucleus. The need for a small, but nonzero, contribution from the tensor M1 operator is pointed out.

58677 Nuclear structure and heavy-ion reactions. Schiffer, J.P. (Argonne National Lab., IL). pp 205-232 of Nuclear structure and heavy-ion collisions. Bologna, Italy; Society of Italiana di Fisica (1981).

The purpose of these lectures is first to review some of the connections between nuclear reactions and nuclear structure for light projectiles; then to discuss how these connections may help in understanding some of the phenomena in heavy-ion reactions.

58678 Test of the interacting boson model using pion-nucleus inelastic scattering. Lee, T.S.H. (Argonne National Lab., IL). pp 143-147 of Interacting Bose-Fermi systems in nuclei. Iachello, F. (ed.). New York, NY; Plenum Publishing Corporation (1981).

It is shown that the comparison between π^+ and π^- cross sections can be used to test the IBA of Arima and Iachello.

58679 Plans fcr laser hyperfine structure measurement at UNISOR. Carter, H.K. (UNISOR, Oak Ridge, TN); Bingham, C.R. pp 83-88 of Future directions in studies of nuclei far from stability. Hamilton, J.H. (ed.). Amsterdam, Netherlands; North-Holland Publishing Company (1980). Contract AC05-76OR00033.

In April, 1978, the UNISOR executive committee requested a study be done on the feasibility of optical spectroscopy experiments at UNISOR in order to determine nuclear spins, moments and changes in the root-mean-square charge radius ($\delta < r^2 >$). The study showed that it is indeed feasible to perform these measurements on many new isotopes which are produced at UNISOR. Subsequently, plans were made for the development of such a facility and funds were obtained for the capital equipment. A brief review of the technique is given with the details for the experimental procedure we intend to implement. The resolution and sensitivity expected at UNISOR is discussed.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 58679, 58698, 58706, 58710, 58726

58680 (CONF-820738—1) **Population and decay of high-spin states in /sup 157-161/Yb: evolution of nuclear shapes as a function spin and neutron number.** Jaeaeskelaeinen, M.; Sarantites, D.G.; Dilmanian, F.A.; Woodward, R.; Puchta, H.; Beene, J.R.; Halbert, M.L.; Hattula, J.; Hensley, D.C.; Barker, J.H. (Oak Ridge National Lab., TN (USA); Washington Univ., St. Louis, MO (USA). Dept. of Chemistry). 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE82018159.

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

The population and decay of the entry states in /sup 157-161/Yb and /sup 155-158/Er from the reactions of 136- and 149-MeV ^{20}Ne with ^{144}Nd and ^{146}Nd have been investigated with the Spin Spectrometer gated with a Ge detector. Statistical-model calculations reproduce the main features of the entry state populations. The entry lines, <E/sup */> as a function of multiplicity, M/sub γ/ show changes in slope at high M/sub γ/ which are due to changes in the decay mode as a result of changes in nuclear structure. Energy spectra of the continuum γ-rays and angular distributions as a function of M/sub γ/ show the onset of a dipole component localized at 650 +- 100 keV accompanied by an equally intense quadrupole component at twice the energy that continues to evolve to higher energies with increasing multiplicity. For $^{157\ 158\ 159\ 160\ 161}$Yb the dipole component appears at M/sub γ/ = 21,22,23,25, and 27 (at spin I ≈ 38,40,42,45, and 50), respectively. At precisely these multiplicities the entry lines show a decrease in slope. In ^{158}Yb the dipole component disappears at M/sub γ/ = 28 and the entry line resumes its original slope. The results are consistent with the following picture. At low spins for $^{157\ 158}$Yb the nuclear shapes evolve from prolate to slightly oblate particle-aligned structures. At I ≈ 38,40,42,45, and 50 the $^{157\ 158\ 159\ 160\ 161}$Yb nuclei, respectively, develop high-K rotational bands which may be built on oblate structures with large deformation ($\epsilon \approx 0.3$). At I = 49 a transition to triaxial shape appears to occur in ^{158}Yb.

58681 (INIS-mf—7116, pp vp) **Electric multipole moments of heavy, deformed nuclei from inelastic proton scattering.** Banks, S.M. (Melbourne Univ., Parkville (Australia)). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58682 (INIS-mf—7116, pp vp) **Measurements of gyromagnetic ratios of excited states in even tungsten isotopes.** Ryan, C.G.; Foot, P.B.; Bolotin, H.H. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58683 (INIS-mf—7116, pp vp) **High spin states in ^{172}Os and ^{174}Os, and backbending systematics.** Dracoulis, G.D.; Fahlander, C.; Byrne, A.F. (Australian National Univ., Canberra. Dept. of Nuclear Physics); Durell, J.L. (Manchester Univ. (UK). Schuster Lab.). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58684 (INIS-mf—7175) **Nuclear spectroscopic studies in ^{162}Yb.** Behrens, H. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet Physik). 28 Jul 1980. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780721.

Thesis.

The decay of the highly excited ^{162}Yb nuclei formed in the reaction ^{150}Sm(^{16}O,4n)^{162}Yb to the ground state was studied using different gamma detectors and an electron spectrometer, a so called mini-orange. The isotope ^{162}Yb was moreover produced and spectroscoped by the beta-decay of ^{162}Lu. For the identification of decay cascades, which were passed after the fusion, and for the determination of the multipolarity of the contributing energy transitions a series of experiments took place: The excitation functions and the angular distributions of the emitted gamma radiation was measured, the conversion coefficients of important transitions were determined, and coincidence events between two detectors occasionally were registrated and analyzed. In the beta decay measurement an assignment of gamma transitions to ^{162}Yb followed due to the lifetime, under which they occured. The found states of ^{162}Yb upto spins of 22 h/2π and excitation energies above 5 MeV belong to five rotational bands. The yrast band shows a weak backbending. Corresponding to their spins and parities the bands can be reduced to intrinsic excitation of two quasineutrons. The analysis of the beta-decay of ^{162}Lu, which takes place from three states in ^{162}Lu, leads to the lowest levels of the gamma-vibrational band and the band head of the beta band. The microscopic interpretation of the rotational bands and the description of the backbending behaviour are as the interpretation of the states involved at the beta decay in agreement with experimental and theoretical results for neighbouring ytterbium isotopes. (orig.).

58685 (INP—1108/PL) **Study of the properties of nuclei far from the beta stability line.** Lizurej, H.I. (Institute of Nuclear Physics, Krakow (Poland)). 1980. 129p. (In Polish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82702328.

A complex of setups for measuring the lifetime of excited states of nuclei by the method of delayed electron-gamma and gamma-gamma coincidences in the range 10^{-10}-10^{-6}s is presented. The methods allowing for a substantial increase in the accuracy and efficiency of obtaining experimental data are developed. The procedures of measuring and analysing the multicomponent beta spectra with taking into account the instrumental effect which distorts the measured spectra are developed. Results of investigating the positron decay and determining the mass difference Qsub(B)+ for nuclei with Tsub(1/2)>20 min by the method of measuring the positron end-point energy are presented. The nano- and subnanosecond isomers for short-lived isotopes far from the beta stability line have been investigated. Probabilities of the electromagnetic transitions which depopulate the low-lying excited states in ^{151}Tb, ^{153}Dy, ^{160}Tm, sup(157,159,161)Er have been determined and analysed.

58686 **Transition from collective to aligned-particle configurations at high spin in ^{154}Dy.** Pakkanen, A.; Chung, Y.H.; Daly, P.J. (Purdue University, West Lafayette, Indiana 47907). *Physical Review Letters;* **48**: No. 22, 1530-1533(31 May 1982).

The high spin level structure of ^{154}Dy has been determined through the (^{34}S,4nγ) reaction. Lifetimes have been measured by use of the recoil-distance method. Both the level structure and lifetimes indicate a transition from collective to few-particle characteristics at high spin, possibly suggesting a changing shape from prolate through triaxial to oblate.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 58630, 58639, 58651, 58655, 58663

58687 (CONF-810920—24) **Study of the ^{208}Pb(n,γ_0) reaction between 0.8 and 5.9 MeV.** Joly, S.; Grenier, G.; Drake, M.; Rigaud, F. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France); Los Alamos National Lab., NM (USA); Centre d'Etudes Nucleaires de Bordeaux-Gradignan (France)). 1981. 2p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903167.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

Portions of document are illegible.

The ^{208}Pb(n,γ_0) reaction was studied from 0.8 to 5.9 MeV to investigate the relative contributions of the compound-nucleus and direct-semidirect (DSD) processes in this energy range. A second objective was to search for a possible excitation of the M1 giant resonance when comparing the measured asymmetry factors for the ground-state transition to the predictions of the DSD model. Results are given. (WHK)

58688 (INIS-mf—7110) **Absolute determination of the photofission cross section of ^{209}Bi with monochromatic gamma radiation between 40 and 65 MeV.** Lemke, H.D. (Mainz Univ. (Germany, F.R.). Fachbereich Physik). 9 Nov 1979. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780714.

Thesis.

Using monochromatic photons produced by positron anihilation in flight the photofission cross sections of ^{209}Bi in the energy range from 40 to 65 MeV were determined. The result of these measurement shows that in the energy range between 40 and 65 MeV the photoreactions take place in an increasing way not via the formation and the statistic decay of a compound state. (orig./HSI).

58689 (INIS-mf—7116, pp vp) **Influence of octupole vibration particle coupling on E3 transitions between high spin states in nuclei near ^{208}Pb.** Poletti, A.R. (Auckland Univ. (New Zealand). Dept. of Physics); Dracoulis, G.D.; Fahlander, C. (Australian National Univ., Canberra. Dept. of Nuclear Physics); Morrison, I. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58690 (INIS-mf—7116, pp vp) **Gyromagnetic ratio determinations of excited states in ^{196} ^{198}Pt.** Stuchbery, A.E.; Ryan, C.G.; Morrison, I.; Bolotin, H.H. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58691 (INIS-mf—7116, pp vp) **Core excited spin isomers in Rn nuclei.** Dracoulis, G.D.; Fahlander, C.; Byrne, A.F. (Australian National Univ., Canberra. Dept. of Nuclear Physics); Poletti, A.R. (Auckland Univ. (New Zealand). Dept. of Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58692 **(IPNO-TH—81-5) Fixed J spectral distribution in large shell model spaces. II. Fixed J configuration centroids and widths.** Jacquemin, C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jan 1981. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702315.

A method is developed to exactly calculate the fixed J configuration centroid energies and widths. The resulting approximate level densities for ^{204}Pb and ^{202}Pb show large departures with respect to the gaussian approximate level densities. The goodness of the polynomial expansion of fixed J configuration moments is studied and a simple improvement to this approximation is proposed which gives very good results.

58693 **(JYFL-RR—14/81) Low-seniority shell-model structure of ^{212}At.** Loennroth, T.; Rahkonen, V.; Fant, B. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Sep 1981. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702719.

Using the reaction ^{209}Bi(α,n) states in the nucleus ^{212}At were populated. The decay of excited states was studied using conventional in-beam γ-ray and conversion-electron spectroscopy. A great number of new levels were established and assigned spins and parities and the previously reported yrast cascade was confirmed. A new Tsub(1/2) = 32 +- 1 ns isomer at 275.4 keV is reported and interpreted to be the 5^- state of the πjsub$(0^+)^2$hsub(9/2)νgsub(9/2) configuration. The configurations were calculated as belonging to the neutror-proton seniority-2 two multiplets where the available orbitals are hsub(9/2), fsub(7/2) and isub(13/2) for the protons and gsub(9/2), isub(11/2) and jsub(15/2) for the neutrons. Configuration mixing is shown to be essential in order to account for the experimental findings. On the basis of isomeric lifetimes the effective charges are discussed.

58694 **Production of negative pions with 183-MeV/nucleon Ne beams.** Nagamiya, S.; Hamagaki, H.; Hecking, P.; Kadota, S.; Lombard, R.; Miake, Y.; Moeller, E.; Schnetzer, S.; Steiner, H.; Tanihata, I.; Bohrmann, S.; Knoll, J. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **48**: No. 26, 1780-1783(28 Jun 1982). Contract W-7405-ENG-48.

Cross sections for negative pion production in 183-MeV/nucleon Ne+NaF and Ne+Pb collisions have been measured at laboratory angles from 20° to 90°. Almost isotropic angular distributions in the nucleon-nucleon c.m. frame are observed. The energy spectra in this frame are of an exponential type with an inverse slope of 25 MeV for NaF and 26 MeV for Pb. No evidence of a bump predicted to result from pionic instability is observed. Possible mechanisms for producing high-energy pions are discussed.

58695 **Fission and deep spallation characteristics in relativistic nuclear collisions.** Warwick, A.I.; Baden, A.; Gutbrod, H.H.; Maier, M.R.; Peter, J.; Ritter, H.G.; Stelzer, H.; Wieman, H.H.; Weik, F.; Freedman, M.; Henderson, D.J.; Kaufman, S.B.; Steinberg, E.P.; Wilkins, B.D. (Gesellschaft fuer Schwerionenforschung, Darmstadt 0-6100, West Germany). *Physical Review Letters;* **48**: No. 25, 1719-1722(21 Jun 1982). Contract AC03-76SF00098;W-31-109-ENG-38.

Numbers of emitted fast charged particles associated with heavier nuclear fragments are employed as a graphic means of differentiating fission and spallation contributions to target fragment emission in relativistic nuclear collisions. The violent nature of the deep spallation mechanism is observed directly.

58696 **Excitation of low lying natural parity levels in ^{208}Pb by inelastic electron scattering.** Heisenberg, J.; Lichtenstadt, J.; Papanicolas, C.N.; McCarthy, J.S. (University of New Hampshire, Durham, New Hampshire 03824). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2292-2308(May 1982).

High resolution electron scattering measurements on ^{208}Pb have been performed at 90° and 160° which allow the spatial reconstruction of transition charge densities and for the first time, transition current densities. The measurement covering the momentum transfer range of $0.5<q<2.6$ fm^{-1} is supplemented by high momentum transfer data from Saclay, extending the data for some of the states up to a momentum transfer of 3.4 fm^{-1}. We report on the first three J/sup π/ = 5^- states and the first J/sup π/ = 7^- state. Transition charge densities have been also extracted for the lowest J/sup π/ = 2^+, 4^+, 6^+, and 8^+ states. The densities are compared to a number of theoretical calculations. Transverse electric currents are shown for the 5^- states that indicate a quenching of the magnetization current similar to observations from other states but the absence of quenching in the convection current contribution.

58697 **Macroscopic nucleon-nucleon correlations caused by the bounce-off process in energetic collisions of heavy nuclei.** Csernai, L.P.; Greiner, W.; Stoecker, H.; Tanihata, I.; Nagamiya, S.; Knoll, J. (Institut fuer Theoretische Physik, Johann Wolfgang Goethe Universitaet, Robert-Mayer-Strasse 8-10, D-6000 Frankfurt am Main 1, Germany). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2482-2490(May 1982). Contract W-7405-ENG-48.

Two-particle correlation data are presented for the reaction Ar (800 MeV/nucleon)+Pb. The experimental results are analyzed in the nuclear fluid dynamical and in a linear cascade model. We demonstrate that the collective hydrodynamical correlations dominate the measured two-particle correlation function for the heavy system studied. We discuss the transition from the early stages of the reaction which are governed by few nucleon correlations, to the later stages with their macroscopic flow which can only be reached using heavy colliding systems. The sensitivity of the correlation data on the underlying compressional and dissipative processes is analyzed.

58698 **Dissipative reaction dynamics of heavy-ion collisions.** Schroeder, W.U.; Huizenga, J.R. (Univ. of Rochester, NY). *Comments on Nuclear and Particle Physics;* **10**: No. 1, 19-31(1981).

Experimental studies of damped nuclear reactions have yielded evidence for the formation of a transient dinuclear system that dynamically evolves in time while microscopic processes lead to a gradually increasing complexity of the reaction bridging the gap from quasielastic to fusion collisions. There are strong indications for the dominance of the stochastic exchange of independent nucleons in damped reactions leading to the dissipative and fluctuative phenomena observed. There may also be other mechanisms proceeding concurrently, but it remains an experimental and theoretical task to establish the conditions under which such alternative mechanisms may be positively identified.

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 58720

58699 (CEA-CONF—5835) **Selected topics in low-energy fission.** Michaudon, A. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Jul 1981. 1p. (CONF-810794—1(Abst.)). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702319.

From Neutron interlaboratory seminar; Oxford, UK (1 Jul 1981).

58700 (CEA-CONF—5967) **Optical and statistical model calculation of the americium 242m capture cross section.** Tellier, Henry. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Etudes des Reacteurs et de Mathematiques Appliquees). Apr 1981. 15p. (CONF-8104157—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702320.

From 22. meeting NEANDC; Aix-en-Provence, France (6 Apr 1981).

The capture cross sections of Am 242m can be deduced from resonances analysis at low energy and computed with theoretical models at high energy. In this work, a coherent set of cross sections which reproduced the experimental values of the fission cross sections is computed. These calculations were performed for an energy of the incoming neutron between 1 keV and 1 MeV.

58701 (INIS-mf—7116, pp vp) **Predicted directional mass asymmetry in ^{230}Th(n,f) using polarized neutrons.** Lang, D.W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Applied Physics Div.:. 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58702 (INIS-mf—7116, pp vp) **Mass resolution correction in double-energy fission measurements.** Lang, D.W.; Walsh, R.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Applied Physics Div.). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58703 (INIS-mf—7116, pp vp) **Search for a directional mass asymmetry in ^{230}Th(n,f).** Boldeman, J.W.; Walsh, R.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Applied Physics Div.). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58704 **(INIS-mf—7142) Angular momentum distribution of primary fission fragments by measurement of the relative yield of isomeric fission products.** Dornhoefer, H. (Goettingen Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 17 Dec 1980. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780718.

Thesis.

The fission products ^{132}I and ^{136}I produced in the fission reactions ^{238}U(α,f) and ^{238}U(d,f) were spectroscoped using a gas transport system. Thereby was taken advantage of the fact that at the transport with pure helium without aerosols only iodine activities were collected in a membrane filter. The relative independent yields of the isomeric fission products of ^{132}I and ^{136}I were determined for different excitation energies. Thereby was taken advantage of the fact that the transport yield of the gas transport system for ^{136}I directly produced from the fission was greater than for iodine indirectly produced by β-decay. (orig./HSI).

58705 **(INIS-mf—7182) Coulomb excitation of ^{226}Ra.** Zimmermann, R. (Muenchen Univ. (Germany, F.R.). Fachbereich Physik). 10 Nov 1980. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780727.

Thesis.

The isotope ^{226}Ra was studied by multiple Coulomb excitation with a 135 MeV e.g. 150 MeV ^{32}S-beam and with a 243 MeV ^{58}Ni beam. Using particle gamma coincidences the gamma decay of the levels populated at the Coulomb excitation can be observed in spite of the natural target activity. The measured gamma energies and gamma intensities allow the establishment of a level scheme for ^{226}Ra with the following energy and spin assignments: 67.67 keV (2^+), 211.54 keV (4^+), 416.6 keV (6^+), 669.4 keV (8^+), 960.0 keV (10^+), 1281 keV (12^+), 1633 keV (14^+) in the ground state band and 253.7 keV (1^-), 321.5 keV (3^-), 446.5 keV (5^-), 626.9 keV (7^-), 857.9 keV (9^-), 1134 keV (11^-), 1446 keV (13^-) in the (Ksup(π) = 0^-) band. Furthermore two lines at 398 keV and 408 keV with low intensity are found. These could result from the gamma decay of possibly existing 2-phonon octupole vibrational states. By semiclassical Coulomb excitation calculations absolute values for E1-, E2-, and E3-transition probabilities within e.g. between the bands are determined using a nonlinear X^2fit from the measured gamma intensities. The results are discussed using different theoretical models. (orig.).

58706 **(JINR-R—7-81-184) Investigation of time components of the ^{238}U+^{12}C and W+^{22}Ne fission reactions.** Bugrov, V.N.; Karamyan, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702334.

Blocking minima are studied in angular distributions of fission fragments formed at irradiating UO_2 monocrystalline targets by ^{12}C ions and W by ^{22}Ne ions with energies equal to 81 and 174 MeV respectively. The data on radiation damage of monocrystals are obtained. The time delay of fission reactions is investigated. The long-lived time component of fission (tau > or approximately 10^{-16} s) associated with the contribution of direct nuclear reaction products is observed in the ^{238}U+^{12}C reaction.

58707 **Energy levels of ^{249}Cm from measurements of thermal neutron capture gamma rays.** Hoff, R.W.; Davidson, W.F.; Warner, D.D.; Boerner, H.G.; von Egidy, T. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 5, 2232-2254(May 1982). Contract W-7405-ENG-48.

The excited levels of ^{249}Cm have been determined by use of neutron-capture gamma-ray spectroscopy. Gamma-ray measurements were made with curved-crystal spectrometers of focal lengths 5.8 and 24 m and a pair spectrometer. These experimental data represent the first measurement of gamma transitions depopulating the levels of ^{249}Cm. We present evidence for the population of 23 levels in ^{249}Cm up to 1300-keV excitation. The following new configuration assignments were made (listed with the corresponding bandhead energies): $(5/2)^+[622]$, 529.58 keV; $(3/2)^-[752]$, 772.74 keV; $(1/2)^-[501]$, 917.49 keV. Comparison of the experimentally determined level structure with theoretical calculations shows best agreement with calculations by Soloviev's group where a Woods-Saxon potential form was used and quasiparticle-phonon coupling was included. The neutron binding energy was determined to be 4713.7 +- 0.3 keV.

58708 Coherent collective flow versus independent two-nucleon collisions in central high-energy heavy-ion collisions. Nix, J.R.; Strottman, D.; Yariv, Y.; Fraenkel, Z. (Max-Planck-Institut fuer Kernphysik, D-6900 Heidelberg, Federal Republic of Germany). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2491-2497(May 1982).

For central collisions in the reaction $^{20}Ne+^{238}U$ at a laboratory bombarding energy per nucleon of 393 MeV, we calculate the cross section $d^2\sigma/dE\ d\Omega$ for outgoing charged particles by means of a relativistic intranuclear cascade, conventional relativistic nuclear fluid dynamics, and relativistic nuclear two-fluid dynamics. The results of the three calculations are compared with recent high-multiplicity-selected central-collision experimental data of Stock et al., including contributions from protons, deuterons, and tritons. The intranuclear cascade reproduces most features of the experimental data except the observed sidewards peaking in the angular distributions at low outgoing energy, predicting instead angular distributions that are forward peaked at all outgoing energies, to within statistical errors. Conventional nuclear fluid dynamics fails to reproduce the experimental data in two important respects: (1) the predicted energy spectra in forward directions decrease too rapidly with increasing outgoing energy and (2) the predicted angular distributions are too narrow and peak at increasingly larger angles with increasing outgoing energy, opposite to the experimental trend. Nuclear two-fluid dynamics predicts sidewards peaking for central collisions at intermediate outgoing energy that is in approximate agreement with experimental results, although the calculated peak is somewhat sharper than the experimental peak. With qualifications arising from the possible importance of contributions from large impact parameters, heavy composite particles, Coulomb effects, and thermal folding, we conclude that in central high-energy heavy-ion collisions the target and projectile interpenetrate substantially but that some degree of coherent collective flow is involved.

58709 Lifetime of the long-lived isomer of ^{236}Np from α-, β- and electron-capture decay measurements. Lindner, M.; Dupzyk, R.J.; Hoff, R.W.; Nagle, R.J. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Journal of Inorganic and Nuclear Chemistry;* **43**: No. 12, 3071-3080(1981).

The half-life of long-lived ^{236}Np, due to α, β and electron-capture decay, was found to be 1.55 x 10^5 yr. Of all decays, 88% populate excited states in ^{236}U and 12% populate levels in ^{236}Pu. Lifetimes measured by growth of the ground states of ^{236}U and ^{236}Pu agree with values from corresponding γ de-excitations in these daughter nuclei. Therefore, nearly all the electron-capture decays populate the 6^+ level of the ground-state band in ^{236}U. Similarly, essentially all the β^- decay populates an analogous 6^+ level in ^{236}Pu, which de-excites through a previously unreported transition of 158.3 keV. If a very week γ-ray at 894 keV can be ascribed to a level in ^{232}U populated by β decay of ^{232}Pa, its existence establishes a 0.2% α-branching decay in ^{236}Np.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 58591, 58678, 58697

58710 (BNL—31486) IBA in deformed nuclei. Casten, R.F.; Warner, D.D. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 48p. (CONF-820385—1). NTIS, PC A03/MF A01. Order Number DE82018062.

From International school of nuclear physics conference; Trapain, Sicily, Italy (27 Mar 1982).

The structure and characteristic properties and predictions of the IBA in deformed nuclei are reviewed, and compared with experiment, in particular for ^{168}Er. Overall, excellent agreement, with a minimum of free parameters (in effect, two, neglecting scale factors on energy differences), was obtained. A particularly surprising, and unavoidable, prediction is that of strong $\beta \rightarrow \gamma$ transitions, a feature characteristically absent in the geometrical model, but manifest empirically. Some discrepancies were also noted, principally for the K=4 excitation, and the detailed magnitudes of some specific B(E2) values. Considerable attention is paid to analyzing the structure of the IBA states and their relation to geometric models. The bandmixing formalism was studied to interpret both the aforementioned discrepancies and the origin of the $\beta \rightarrow \gamma$ transitions. The IBA states, extremely complex in the usual SU(5) basis, are transformed to the SU(3) basis, as is the interaction Hamiltonian. The IBA wave functions appear with much simplified structure in this way as does the structure of the associated B(E2) values. The nature of the symmetry breaking of SU(3) for actual deformed nuclei is seen to be predominantly $\Delta K=0$ mixing. A modified, and more consistent, formalism for the IBA-1 is introduced which is simpler, has fewer free parameters (in effect, one, neglecting scale factors on energy differences), is in at least as good agreement with experiment as the earlier formalism, contains a special case of the 0(6) limit which corresponds to that known empirically, and appears to have a close relationship to the IBA-2. The new formalism facilitates the construction of contour plots of various observables (e.g., energy or B(E2) ratios) as functions of N and chi/sub Q/ which allow the parameter-free discussion of qualitative trajectories or systematics.

58711 (CEA-CONF—5930) Born-Oppenheimer coupling between collective and intrinsic degrees of freedom. Giraud, B.G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Sep 1981. 13p. (CONF-8109142—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702305.

From International symposium on clustering phenomena in nuclei; Tuebingen, F.R. Germany (9 Sep 1981).

The splitting of the nuclear Hamiltonian into a collective Hamiltonian, an intrinsic Hamiltonian and a coupling term is shown to be a solvable problem. The solution is equivalent to a change of representation, as examplifield by the multi-channel theory of nuclear scattering or the Born-Oppenheimer representation of molecular dynamics.

58712 (CEA-CONF—6036) Low energy nuclear fission. Nifenecker, H. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Aug 1980. 58p. (CONF-8008136—1). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702308.

From Netherlands Physical Society summer school on nuclear structure; Dronten, Netherlands (13 Aug 1980).

In these lectures the liquid drop model of fission is presented and some of its predictions compared with experiment. The liquid drop analogy allows to define in a rather simple and intuitive way a number of useful concepts and possible observables. It is shown how a synthesis of the liquid drop model and of the shell model can be made using the Strutinsky shell averaging procedure. Some experimental data related to the existence of shape isomers are presented and discussed. We conclude by discussing some aspects, both experimental and theoretical, of fission dynamics.

58713 (EFI—487(30)-81) Nuclear forces and quantum chromodynamics. Muradian, R.M. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702311.

The mechanism of the nuclear force origin is discussed. It is supposed that at short distances nucleons exchange coloured quarks in consistency with QCD general notions. The obtained relation between binding energies of light nuclei does not contradict experimental data. It is shown that besides the ordinary two-body forces in the system of three or more nucleons should exist three-body forces.

58714 (INIS-mf—6968, pp 361-377) **Single determinantal reaction theory as a Schroedinger analog: the time-dependent S-matrix Hartree-Fock method.** Griffin, J.J.; Lichtner, P.C.; Dworzecka, M.; Kit-Keung Kan (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1979. NTIS (US Sales Only), PC A18/MF A01.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

The TDHF method is suggested to be considered not as an approximation to but as a model of the exact Schroedinger system. Thus the TDHF description of continuum reactions can be reconstructed from an initial value problem into a form analogous to the S matrix version of the Schroedinger theory. Periodic solutions then play the role of stationary eigenstates in the construction of suitable asymptotic reaction channels.

58715 (INIS-mf—7058, pp 413-427) **Transfer of momentum, mass and charge in heavy ion collisions.** Beck, F.; Feldmeier, H. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik); Dworzecka, M. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1979. NTIS (US Sales Only), PC A20/MF A01.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

A model for the first two phases of heavy ion collisions based on the transport of single nucleons through the window between the two scattering nuclei is described in some detail. It is pointed out that the model can account simultaneously for a large portion of the energy transfer from relative to intrinsic motion and for the observed variances in mass and charge numbers for reaction times up to the order of 10^{-21} s.

58716 (INIS-mf—7116, pp vp) **Fission and evaporation residue measurements near to the ^{208}Pb closed shell.** Charity, R.J.; Galster, W.; Hinde, D.; Leigh, J.R.; Newton, J.O.; Ward, D.; Sie, S.H. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58717 (INP—1127/PL) **Uncertainty of the shape of the local optical model potential.** Dabrowski, H.; Freindl, L. (Institute of Nuclear Physics, Krakow (Poland)). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702313.

The formulas for the errors of the shape of the optical model potential connected with the experimental errors were deduced basing on the covariance matrix of potential parameters. The "corridor" of errors for real part of the potential was calculated for the elastic alpha particle scattering on ^{90}Zr case at energies 40, 99.5 and 118 MeV. The errors of the volume integrals and root mean square radius (rmsr) were also calculated using the same method. The character of the obtained "corridor" may be simply explained in terms of the impact parameter and strong absorption of alpha particles.

58718 (INP—1129/PL) **Cluster properties of the giant monopole resonances EO in the light and medium mass nuclei.** Knyr, V.A.; Smirnov, Yu.F. (Institute of Nuclear Physics, Krakow (Poland)). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702314.

The connection between the cluster spectroscopic factors of the giant monopole isoscalar resonances EO and the ground states of nuclei has been established by means of the formalism of the Sp(2,R) group. These relations allow to analyse the dependence of the cluster properties of the isoscalar EO giant resonances on the mass number A.

58719 (ITEF—98(1981)) **Coulomb problem with a short-range interaction. Bound states and resonances.** Popov, V.S.; Kudryavtsev, A.E.; Lisin, V.I.; Mur, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 45p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702491.

The problem on the Coulomb potential distorted at small (r approximately $r_0 << \alpha$sub(β)) distances, r_0 - radius of strong interaction, αsub(β) - Bor radius, is considered. The equation determining the pole position of the S matrix on K complex plane is obtained. The pole motion at increase of Vsub(S) strong potential depth is investigated. The pole motion nature varies qualitatively depending on the fact whether the Coulomb interaction is attraction or repulsion as well as on the l orbital momentum value ($l=0$ or $l>=1$). Limiting cases are considered and asymptotic formulas binding the pole position with scattering length and effective radius are obtained. Numerical calculation results are discussed as well.

58720 (NASA-CR—168848, pp 260-267) **Fluid dynamical description of relativistic nuclear collisions.** Nix, J.R.; Strottman, D. Mar 1982. NTIS, PC A17/MF A01.

From 2. convention of the international colloquium on drops and bubbles; Monterey, CA, USA (19 Nov 1981).

On the basis of both a conventional relativistic nuclear fluid dynamic model and a two fluid generalization that takes into account the interpenetration of the target and projectile upon contact, collisions between heavy nuclei moving at relativistic speeds are calculated. This is done by solving the relevant equations of motion numerically in three spatial dimensions by use of particle in cell finite difference computing techniques. The effect of incorporating a density isomer, or quasistable state, in the nuclear equation of state at three times normal nuclear density, and the effect of doubling the nuclear compressibility coefficient are studied. For the reaction 20Ne + 238U at a laboratory bombarding energy per nucleon of 393 MeV, the calculated distributions in energy and angle of outgoing charged particles are compared with recent experimental data both integrated over all impact parameters and for nearly central collisions.

58721 **Mesonic folded diagram theory of the nucleon-nucleon potential.** Li, G.; Ng, K.K.; Kuo, T.T.S. (Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 6, 2877-2882(Jun 1982). Contract AC02-76ER13001.

We propose a general theory for deriving the nucleon-nucleon (NN) potential V from meson exchanges. Our potential preserves the half-on-shell NN T matrix, contains mesonic folded diagrams and is energy independent. Mesonic folded diagrams are estimated to be of negligible effect for the long-range part of V but may be important for its medium- and short-range parts.

58722 **Coulomb final state interaction and the charge effect in heavy ion projectile fragmentation at intermediate energies.** Wong, C.Y.; Van Bibber, K. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 6, 2990-2995(Jun 1982).

In intermediate energy heavy-ion projectile fragmentation the width of the transverse momentum distribution for a given fragment mass depends on the charge number of the fragment. The greater the charge number, the smaller is the width of the transverse momentum distribution. Such a charge effect may be explained in terms of a Coulomb final state interaction between the fragment and the protons dissociated from the projectile. With simple assumptions concerning the fragmentation process, analytic expressions for the momentum dispersions are obtained and are found to give good agreement with experimental results.

58723 **Microscopic study of the Δ-nucleus potential from a many-body Hamiltonian for π, N, and Δ^+.** Lee, T.H.; Ohta, K. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] C: Nuclear Physics;* **25**: No. 6, 3043-3049(Jun 1982). Contract AC02-76ER03069.

The strength of the Δ-nucleus potential is calculated from the many-body Hamiltonian for π, N, and Δ constructed by Betz and Lee. The results are compared to the empirical values of the Δ-hole doorway model. It is found that the calculated strength of the central potential reproduces the empirical one to a large extent. However, the calculated spin-orbit potential is much smaller than that of the Δ-hole model. It is also shown that the pion absorption through the NΔ S-wave only accounts for about half of the total absorption. The sum of other NΔ partial waves are found to be equally important.

58724 **Elastic isovector vibrations and the boundary conditions.** Azziz, N.; Palathingal, J.C.; Wong, C.Y. (University of Puerto Rico, Mayaguez, Puerto Rico, 00708). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 6, 3110-3114(Jun 1982).

The elastic model, which successfully explains the isoscalar giant resonances, is now applied to study the isovector giant resonances. In solving the Lame equation, we employ the boundary condition that the displacement shall vanish at the surface. The results are compared with those obtained under the contrasting boundary condition that the stresses shall be absent at the surface. It was found that the results are dependent on the type of boundary conditions. Future experimental data will allow the assessment of the correct choice of boundary conditions.

58725 **Comment on "Exactly central heavy-ion collisions by nuclear hydrodynamics".** Csernai, L.P.; Stoecker, H. (Institut fuer Theoretische Physik, Johann Wolfgang Goethe Universitaet, 6000 Frankfurt am Main, Germany). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 6, 3208-3211(Jun 1982). Contract W-7405-ENG-48.

Problems arising in viscous nuclear fluid dynamical models of high-energy heavy-ion collisions are discussed. The importance of an accurate treatment of the transport properties of the hot and dense nuclear matter is pointed out.

58726 **Modified formulation of the phenomenological interacting boson approximation.** Warner, D.D.; Casten, R.F. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **48**: No. 20, 1385-1389(17 May 1982). Contract AC02-76CH00016.

Previous interacting-boson-approximation studies of deformed nuclei have used different forms of the quadrupole operator in the Hamiltonian and E2 operators. A revised formalism is proposed which employs consistent operators and embodies a simpler Hamiltonian. It yields improved agreement with the data for deformed nuclei, a number of parameter-free predictions for transition regions, and a specific form of the O(6) limit which agrees with that found empirically.

58727 **Inclusion of deuteron and alpha-particle collisions in intranuclear cascade calculations.** Mathews, G.J.; Glagola, B.G.; Moyle, R.A.; Viola, V.E. Jr. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2181-2195(May 1982).

An intranuclear cascade model generalized to allow deuteron and alpha-particle collisions during the cascade is discussed. A comparison of calculations is presented for nucleon-induced cascades with and without clusters present in the target nucleus and the effects of clustering are inferred. Alpha-particle-induced collisions are studied in detail and compared with experimental data. It is found that many features of alpha-particle-induced reactions can be well understood with this model. Possible shortcomings and directions of future improvements in the code are highlighted.

58728 **Positive energy Weinberg states for the solution of scattering problems.** Rawitscher, G. (Center for Theoretical Physics, Laboratory for Nuclear Science and ment of Physics). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2196-2213(May 1982). Contract AC04-79ET23001;AC02-76ER03069.

Positive energy Weinberg states are defined and numerically calculated in the presence of a general complex Woods-Saxon potential. The numerical procedure is checked for the limit of a square well potential for which the Weinberg states and the corresponding eigenvalues are known. A finite number M of these (auxiliary) positive energy Weinberg states are then use as a set of basis functions in order to provide a separable approximation of rank M, V/sub M/, to a potential V, and also to the scattering matrix element S which obtains as a result of the presence of V, S/sub M/. Both V/sub M/ and S/sub M/ are obtained by means of algebraic manipulations which involve the matrix elements of V calculated in terms of the auxiliary postive energy Weinberg states Next, expressions are derived which enable one to iteratively correct for the error in V—V/sub M/. These expressions are a modified version of the quasi-particle method of Weinberg. The convergence of S/sub M/ to S, as well as the first order interation of the error in S/sub M/ is examined as a function M for a numerical example which uses a complex Woods-Saxon potential for V and assumes zero angular momentum. With M = 5 and one iteration an error of less than 10% in S is achieved; for M = 8 the error is less than 1%. The method is expected to be useful for the solution of large systems of coupled equations by matrix techniques or when a part of the potential is non-local.

58729 **Equilibrium shapes and fission barriers of rotating nuclei with a macroscopic two-center model.** Mustafa, M.G.; Baisden, P.A.; Chandra, H. (Nuclear Chemistry Division, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2524-2533(May 1982).

Equilibrium shapes and fission barriers of rotating nuclei have been calculated using a macroscopic two-center model, with a finite-range nuclear force and a diffuse nuclear surface. Our model differs from the rotating-liquid-drop model of Cohen, Plasil, and Swiatecki in the shape parametrization and in the calculations of the surface, Coulomb, and rotational energies. We use the two-center-model shape parametrization, which allows for triaxial shape variations and a continuous transition from one-center to two-center shapes with a smooth neck. We calculate the surface energy with the Yukawa-plus-exponential folding function of Krappe, Nix, and Sierk, which incorporates the effects of the finite range of the nuclear force and the diffuse nuclear surface, and calculate both the Coulomb and rotational energies with surface diffuseness described by a Yukawa folding function. The calculation includes beta-stable nuclei up to mass number A = 250 and selected nuclei off the line of beta stability. The results are compared with the predictions of the rotating-liquid-drop model and with experimental results statistically deduced from heavy-ion induced reactions.

58730 **Meson fields with vanishing expectation values.** Bolsterli, M. (Schweizerisches Institut fuer Nuklearforschung, CH-5234 Villigen, Switzerland). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2728-2732(May 1982).

A method for treating meson fields whose expectation values must vanish because of symmetry is presented in terms of a simplified model of pions, nucleons, and deltas constituting a model alpha particle. Self-consistent equations for the wave functions are derived from the variational principle. The relation to the mean-field procedure, which can be used for fields with expectation values, is discussed.

58731 **Collective transitions at high level density.** Leander, G. (Florida State University, Tallahasse, Florida and UNISOR, Oak Ridge Associated Universities, Oak Ridge, Tennessee). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2780-2786(May 1982).

It has been assumed that highly excited collective bands, more or less parallel to the yrast line, are important for the gamma deexcitation of rotational nuclei formed in heavy-ion reactions. This paper draws attention to the possibility that the in-band decay of any given state may be spread over a broad spectrum and discusses the implications of the cascade process. A simple model, where bands are generated by coherent matrix motion in the Gaussian orthogonal ensemble, indicates how the spreading width may depend on the fundamental nature of nuclear level structure.

58732 **Dynamics of nuclear fluid. VII. Isovector, spin-vector, and spin-isovector giant multipole resonances as elastic vibrations.** Wong, C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2787-2794(May 1982).

Previously, we studied the isoscalar giant resonances as the elastic vibration of a nucleus, the peculiar properties of elasticity being a manifestation of the quantum stress tensor. We examine here the other types of collective vibrations involving elastic spin and isospin waves. Relevant electric and magnetic multipole states for the isovector, the spin vector, and the spin-isovector modes are determined. We find that for a given electric or magnetic state with multipolarity l different from zero, the lowest eigenenergies for the different modes of giant resonances (isoscalar, isovector, spin-vector, and spin-isovector) are approximately degenerate. On the other hand, the l/sup π/ = 0^+ states depend on the nuclear incompressibility and the symmetry energy coefficients. Their eigenenergies can be quite different. The theoretical eigenenergies for the giant isovector electric multipole states compare well with experimental data.

58733 **Determination of the NN cross section in nuclei from inclusive (π,π') and coincidence ($\pi,\pi N$) reactions.** Piasetzky, E.; Silbar, R.R.; Sternheim, M.M. (Physics Department, Tel Aviv University, Tel Aviv, Israel). *Physical Review* [*Section*] *C: Nuclear Physics;* **25**: No. 5, 2830-2833(May 1982).

A semiclassical model applied to backward inelastic pion-nucleus scattering reproduces the general features of the (π,π') data and suggests a way of extracting the fractions involving pion multiple scattering, nucleon final state interactions, and unperturbed quasifree scattering. In order to fit the knockout (π^+,π^+ p) coincidence data, the free NN cross sections must be reduced by a factor which rapidly increases with A, implying a long mean free path for the outgoing nucleon in heavy nuclei.

58734 **Status of experimental tests of the IBA.** Casten, R.F. (Brookhaven National Lab., Upton, NY). pp 3-20 of Interacting Bose-Fermi systems in nuclei. Iachello, F. (Ed.). New York, NY; Plenum Publishing Corporation (1981).

This review will survey the status of experimental tests of the IBA including a discussion of both IBA-1 and IBA-2. Overall, to date, the IBA has enjoyed enormous success, both in individual nuclei and as a general scheme for the unified treatment of entire regions. As the number of tests of the model has grown recently, the first significant discrepancies have also appeared and will be discussed in some detail. The review is limited to even-even nuclei.

58735 **Nuclear mass relations and equations.** Monahan, J.E.; Serduke, F.J.D. (Argonne National Lab., IL). pp 151-159 of Atomic masses and fundamental constants 6. Nolen, J.A. Jr.; Benenson, W. (eds.). New York, NY; Plenum Publishing Corporation (1980).

Relations among the masses of neighboring nuclei provide a convenient and reasonably accurate method for the estimation of unknown masses. A set of such relations is presented. Each member of this set gives a prediction of roughly equal statistical accuracy for the unknown mass of a given nuclide. The average and dispersion of the set give a most probable mass value and a measure of its uncertainty. The structure of these relations (considered as partial difference equations) lead to another set of difference equations the solutions of which can be ordered such that each successive member is expected to be a more nearly accurate representation of ground-state energies as functions of N and Z. The reliability of such solutions for extrapolation far from the region of known nuclei is discussed.

58736 **Measured population inversion for the VUV region from resonance charge transfer.** Elton, R.C.; Dixon, R.H. pp 1-3 of Fifth international conference on vacuum ultraviolet radiation physics. Washington, DC; Naval Research Laboratory (1977).

From 5. international conference on vacuum ultraviolet radiation physics; Montpellier, France (5 Sep 1977).

Since charge transfer is a collision process, rapid pumping occurs at high densities and inversion is maintained as along as the densities are sufficient and the lower state is more rapidly depleted than it is filled, i.e., quasi-cw inversion and gain become possible. A stringent requirement for this scheme is the creation of a region of high density ion/atom interaction. We have accomplished this with carbon atoms and C^{5+} and C^{6+} ions, all generated from a graphite disc vaporized by a 5J, 16ns Nd-glass laser beam focused to a 0.5 mm spot. The particles interact in a buffer gas at a pressure of 1-5 Torr. The reactions are $C + C^{5+,6+} \rightarrow C^+ + (C^{4+,5+})^* + \Delta E$/sub if, where ΔE/sub if/ if the required exothermic reaction energy defect and the product excited state* is predominantly n = 4. With a cross section of $\sigma \cong 10^{-16} z^2 \cong 4 \times 10^{-15}$ cm^2 for a net ion charge z and a theoretically desirable relative velocity v in the range of (1-8) 10^6 cm/sec, a pumping rate per initial ion of N/sub a/ <σv> ≅ 2 x 10^9 sec^{-1} when compared with a n = 4 final ion depletion rate of ~ 4 x 10^{10} sec^{-1}, implies an ~ 5% n = 4 excitation. A n = 3 lower state depletion rate of 8 x 10^{11} sec^{-1} assures continuous inversion. Here N/sub a/ ≅ 10^{17} cm^{-3} refers to the neutral atom density.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 56416, 56947, 56947, 57474, 57671, 57978, 58338, 58598

58737 **(EFI—466(8)-81) Low energy spectra of 4.7 GeV electron radiation at small entrance angles into diamond crystal.** Avakyan, R.O.; Agan'yants, A.O.; Vartanov, Yu.A.; Vartapetyan, G.A.; Taroyan, S.P. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702257.

The radiation of 4.7 GeV electrons in diamond monocrystal with various orientations and thickness is investigated. A similarity of the spectra as well as a decrease of the multiple scattering of electrons at small entrance angles with respect to the crystallographic plane are observed.

58738 **(FEI—1199) Representation of particle space distribution by Fourier series in the Monte Carlo method.** Androsenko, P.A.; Bolonkina, G.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702304.

Peculiarities of representation of particle spatial distribution density by Fourier series examplified by the gamma radiation propagation problem in barrier geometry are considered. The problem is solved by the semianalytic Monte Carlo method. Recurrent formulas for the Fourier series coefficients are derived. The test calculation results are presented.

58739 **(INIS-mf—7108) Preparation of a bent crystal and its use in neutron scattering.** Kraxenberger, H. (Bayreuth Univ. (Germany, F.R.)). 24 Jul 1980. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780710.

Thesis.

The aim of this thesis was the construction of a horizontally bendable neutron monochromator e.g. analyzator, the application to different measuring problem in neutron scattering, and the development of an exact theory.

58740 (INIS-mf—7116, pp vp) **Neutron propagation in moving matter: the Fizeau experiment with massive particles.** Cimmino, A.; Klein, A.G.; Opat, G.I. (Melbourne Univ., Parkville (Australia). School of Physics). 1982. NTIS (US Sales Only), PC A05/MF A01.

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58741 (INIS-mf—7116, pp vp) **Chalk River research program in stopping powers, and its applications to nuclear physics.** Ward, D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 1982. Dep. NTIS (US Sales Only).

From 9. AINSE nuclear physics conference; Melbourne, Australia (8 Feb 1982).

58742 **(ITEF—97(1981)) Energy dependence of a conversion length of gamma quanta in liquid xenon in the 25-2400 MeV range.** Barmin, V.V.; Barylov, V.G.; Davidenko, G.V.; Demidov, V.S.; Dolgolenko, A.G.; Chistyakova, T.A.; Shebanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702713.

The energy dependence of a conversion length of gamma quanta in liquid xenon in the 25-2400 MeV range is determined by the photos of 180 litre xenon bubble chamber exposed on 3.2 GeV/c π^--meson beams and 0.85 GeV/c K^+ mesons. The results obtained have been compared with the calculation results. The calculations are performed for xenon which contains a small amount of propane impurity. The conversion length is determined by total cross sections of gamma quanta interaction with Xe, C and H atoms. The xenon main contribution into the total cross section value is given by the processes of electron-positron pairs production and of compton scattering. On the basis of data obtained on the conversion length in liquid xenon with a small amount of propane impurity the cross section of electron-positron pairs production in pure xenon is calculated.

58743 **(ITEF—100(1981)) Investigation of characteristics of a spin flipper in form of a foil with current.** Bulgakov, M.I.; Gul'ko, A.D.; Trostin, S.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 44p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702301.

The magnetic field distribution is considered for the current in the foil-sheet of finite width, often used as a spin flipper for the polarized neutrons. It is shown that the decrease of the reversal efficiency with increasing distance of the neutrons from the flipper axis is caused by not antiparallel magnetic field components on the opposite surfaces of the foil. The reason of it is the components of the current foil magnetic field perpendicular to the foil's surface. The formulae for the polarization reversal efficiency (flipping efficiency) for the neutrons, crossing such a spin flipper. The experimental results are given. The method of the compensation of the perpendicular magnetic field component on the foil's surface is reported. It gives the possibility of the considerable enlargement of the region with high reversal efficiency of neutron polarization.

58744 **(SAND—80-1968) Electron energy and charge albedos - calorimetric measurement vs Monte Carlo theory.** Lockwood, G.J.; Ruggles, L.E.; Miller, G.H.; Halbleib, J.A. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1981. Contract AC04-76DP00789. 74p. NTIS, PC A04/MF A01. Order Number DE82006870.

A new calorimetric method has been employed to obtain saturated electron energy albedos for Be, C, Al, Ti, Mo, Ta, U, and UO_2 over the range of incident energies from 0.1 to 1.0 MeV. The technique was so designed to permit the simultaneous measurement of saturated charge albedos. In the cases of C, Al, Ta, and U the measurements were extended down to about 0.025 MeV. The angle of incidence was varied from 0° (normal) to 75° in steps of 15°, with selected measurements at 82.5° in Be and C. In each case, state-of-the-art predictions were obtained from a Monte Carlo model. The generally good agreement between theory and experiment over this extensive parameter space represents a strong validation of both the theoretical model and the new experimental method. Nevertheless, certain discrepancies at low incident energies, especially in high-atomic-number materials, and at all energies in the case of the U energy albedos are not completely understood.

58745 **(SGAE—4031) STOSS - A computer module which can be used in Monte-Carlo-calculation for determining the path of a particle in a heterogeneous medium in three dimensions.** Sdouz, G. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna). Sep 1980. 39p. (In German). (RS—171/80). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702302.

The computer program STOSS determines the path of a particle in a heterogenous medium in three dimensions. The program can be used as a module in Monte-Carlo-calculations. The collision can be transferred from the centre-of-mass system into a fixed cartesian coordinate-system by means of appropriate transformations. Then the path length is determined and the location of the next collision is calculated. The computational details are discussed at some length.

58746 **Experiments concerning electron capture and loss to the continuum and convoy electron production by highly ionized projectiles in the 0.7—8.5-MeV/u range traversing the rare gases, polycrystalline solids, and axial channels in gold.** Breinig, M.; Elston, S.B.; Huldt, S.; Liljeby, L.; Vane, C.R.; Berry, S.D.; Glass, G.A.; Schauer, M.; Sellin, I.A.; Alton, G.D.; Datz, S.; Overbury, S.; Laubert, R.; Suter, M. (University of Tennessee, Knoxville, Tennessee 37916). *Physical Review [Section] A: General Physics;* **25**: No. 6, 3015-3048(Jun 1982).

Velocity spectra of electrons emitted into the forward direction have been measured for 0.7—8.5-MeV/u projectile ions traversing He, Ne, and Ar targets, polycrystalline solids (C, Al, Ag, Au), and axial channels in gold. Spectral shapes and yields are compared and contrasted with one another and with theories which seek to account for the cusp-shaped peaks observed in terms of electron capture and loss to low-lying projectile-centered continuum states. We report the results of both singles and coincidence measurements, where the dependence of cusp shapes and yields on the emergent-ion charge state are examined. For electron capture to the continuum (ECC), variance is noted with respect to the simple, first-order theory of Dettmann, Harrison, and Lucas. The ECC yields are compared to experimental and theoretical studies of bound-state capture, especially to high Rydberg states. For electron loss to low-lying continuum states (ELC), variance is noted with respect to the corresponding theories of Briggs, Drepper, and Day, and ELC cross sections are compared to total electron-loss cross sections. For convoy electron production in solids, no known theory accounts for the results. As in ELC processes, convoy cusp widths are observed to be velocity independent. Convoy electron yields are also observed to be independent of emergent-ion charge state.

58747 **Energy losses and mean free paths of electrons in silicon dioxide.** Ashley, J.C.; Anderson, V.E. (Oak Ridge National Lab., TN). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 6, 4132-4136(Dec 1981). Contract W-7405-ENG-26.

Theoretical models and calculations are combined with experimental optical data to determine a model energy-loss function for SiO_2. Sum-rule checks and comparisons with experimental information are made to insure overall consistency of the model. The model energy-loss function is employed to calculate electron inelastic mean free paths and stopping powers for electrons with energies $\leqq$ 10 keV in SiO_2.

58748 **Inelastic interactions of low-energy electrons with organic solids: simple formulae for mean free paths and stopping powers.** Ashley, J.C. (Oak Ridge National Lab., TN). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **27**: No. 6, 1454-1458(Dec 1980). Contract W-7405-ENG-26.

A theoretical description of the inelastic interactions of low-energy electrons ($E \leqq 10$ keV) with solid organic insulators is presented. The response of the valence electrons to energy and momentum transfers is inferred from a model for the energy-loss function with parameters fixed by optical data. With this model energy-loss function, inverse mean free path and stopping power due to interactions with the valence electrons are calculated for several organic solids. Contributions to the inverse mean free path and stopping power due to K-shell ionization in carbon, nitrogen, and oxygen are obtained from theoretical atomic generalized oscillator strengths. Simple, analytical formulae are deduced which allow predictions of mean free paths and stopping powers for electrons in the energy range 100 eV $\leqq E \leqq$ 10 keV to be made for a large group of organic solids.

58749 Relation among x-ray photoelectron intensities, cross sections and kinetic energies in insulating solids. Howng, W.Y.; Thorn, R.J. (Argonne National Lab., IL). *Journal of Physics and Chemistry of Solids;* **41**: 1147-1155(1980).

The fundamental relation among x-ray (MgK/sub α) photoelectron intensities, theoretical orbital ionization cross sections, and photoelectron kinetic energies has been investigated through precisely measured relative intensities of orbital electrons from sublimed-condensed samples of KF, NaF, CaF_2 and KCl, and other ionic solids. Although the results confirm within approximately 15% the relation and establish a linear dependence of the intensities on analyzer transmission, they suggest that either a slight deviation from the relation exists or a cancellation of errors occurs. Empirically it is found that the relative intensities are proportional to the square of the ratio of kinetic energies, and with this relation, the intensities agree with the theoretical cross sections within a few per cent. This relation suggests that the dependence on the angular parameter is inconsequential and that the mean free path is proportional to the kinetic energy.

58750 (PB—82-157587) Antireflecting sublayers for neutron thin film polarising mirrors. Childs, F.; Hayter, J.B.; Penfold, J.; Williams, W.G. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 36p. (RL—81-082). NTIS, PC A03/MF A01.

Measurements of the neutron polarizing capability of Iron/Cobalt thin film mirrors deposited onto various Gadolinium-rich antireflecting sublayers are presented and the results are compared with theoretical predictions. Excellent results were obtained in the cold neutron region though a degradation in performance is predicted in the thermal region at wavelengths about 1A. (Copyright (c) Science and Engineering Research Council 1981.)

6550 Medical Physics

REFER ALSO TO CITATION(S) 57981

58751 (CONF-820566—1) Method for interpolating in Bondarenko factor tables and other functions. Greene, N.M. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 17p. NTIS, PC AA02/MF A01. Order Number DE82015685.

From Thermal reactor benchmark calculations, techniques, results and applications seminar; Upton, NY, USA (17 May 1982).

A simple, monotonic interpolation procedure is presented which has several advantages. In addition to its generality, its simplicity makes it particularly easy to use in typical computer applications.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 57517

58752 (CEA-CONF—5999) High resolution electron microscopy. Visualization of crystal lattices and of their defects. Desseaux, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Oct 1981. 15p. (In French). (CONF-8109141—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702254.

From Summer school of electron microscopy in material sciences; Bombannes, France (21 Sep 1981).

A great number of fault characterization results may be obtained without calculations simply by observing the pictures: determination of Burgers' vector of dislocations, dissociation of the dislocations, presence of precipitates in the heart of the dislocations, presence of micro-twin-crystals, phase boundaries, etc. Determining the position of the atoms will be facilitated if the phase system approximation can be applied. In those cases where it is necessary to use the calculated image-experimental image comparison, it is fundamental to check the parameters on which the image depends. For the simplicity of the interpretation it is always necessary to obtain images taken in conditions where the structure is the most directly projected and where the image contrast is as stable as possible for a small variation in the parameters: thickness, focusing and crystalline parameters. A few examples are given on silicon.

58753 (DEMO—81/8) Off-diagonal disorder and the metal-insulator transition in impurity bands in semiconductors. Fertis, A.C.; Andriotis, A.N.; Economou, E.N. (Atomic Energy Commission, Athens (Greece)). 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82903466.

Portions of document are illegible.

The role of disorder in the Metal-Insulator (MI) transition in impurity bands in semiconductors is examined by means of a random, one body, tight binding Hamiltonian with pure off-diagonal disorder. A homomorphic cluster CPA is used to calculate the average Green's function and the L(E) criterion is employed to study the localization of electron states. An Anderson transition is found to take place as the impurity concentration reaches a critical value given approximately by n/sub c//sup 1/3/α/sub B//sup */ ≈ 0.16.

58754 (INIS-mf—7059-Vol.1) Proceedings of the international conference on amorphous systems investigated by nuclear methods. Kajcsos, Z.; Dezsi, I.; Horvath, D.; Kemeny, T.; Marczis, L.; Nagy, D.L. (eds.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Magyar Tudomanyos Akademia, Budapest; Eoetvoes Lorand Fizikai Tarsulat, Budapest (Hungary)). 1981. 608p. (CONF-8108121—Vol.1). NTIS (US Sales Only), PC A99/MF A01. Order Number DE82780694.

From International conference on amorphuos systems investigated by nuclear methods; Balatonfuered, Hungary (31 Aug 1981).

Individual items from the conference were prepared separately for the data base. (GHT)

58755 (ITF—80-126P) Theory of electron transfer by solitons. Davydov, A.S. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1980. 49p. (In Russian). Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR.

The effect of strong electron-phonon interaction on the electron motion in a molecular chain formed by molecules with constant electric dipole moments is analyzed. The properties of three-dimensional solitons (polarons) in ion crystals, taking into account the optical-phonon dispersion without employing the perturbation theory relative to ion kinetic energy, are discussed.

58756 (ITF—80-138P) Size effects in layer crystals. Lukiyanets, B.A.; Danilevich-Tovstyuk, K.K. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1980. 16p. (In Russian). Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR.

The layer crystal phonon mode renormalization by electron-phonon interaction depending on the crystal thickness is considered. It is shown that with sample thickness decreasing the sample is less inclined to form structural instabilities.

58757 (ITF—81-3P) Model energy spectrum and thermodynamical properties of the electron gas in strongly anisotropic crystals: transitional region between three-dimensional (3D) and two-dimensional (2D) or one-dimensional (1D) structures. Bercha, D.M.; Maslyuk, V.T. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1981. 31p. (In Russian). Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR.

The strongly anisotropic crystal model spectrum and the electron Hamiltonian in the second quantization form are constructed with due regard to the symmetry of crystals. A nonorthogonality of the wave functions is also taken into account. The temperature and conservation dependence of thermodynamical parameter carriers of current for the simplest layer structures is investigated.

58758 Planar channeling of ions in compound semiconductor superlattices. Barrett, J.H. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Vacuum Science and Technology;* **21**: No. 2, 384-385(Jul 1982). Contract W-7405-ENG-26.

Computer simulations have been done to show how planar channeling of high-energy ions in compound semiconductor superlattices offers a further means of studying structure at the interfaces in these materials. Such a technique will supplement earlier work with axial channeling concerning offsets at the interfaces in rows of atoms inclined to the surface normal. The method involves having the interface at a depth of 10—20 nm and adjusting the ion energy so that the ions travel about one quarter wavelength in reaching the interface. The tilt angle of the beam relative to the planar channel can be varied to sweep the beam across the channel and make a precise determination of the offset position. This procedure can provide a confirmation of the offset and a more accurate determination of its size.

58759 High-strain-rate plastic flow studied via nonequilibrium molecular dynamics. Hoover, W.G.; Ladd, A.J.C.; Moran, B. (Department of Applied Science, University of California at Davis, Davis, California 95616). *Physical Review Letters;* **48**: No. 26, 1818-1820(28 Jun 1982). Contract W-7405-ENG-48.

Recent experiments at strain rates reaching 0.1 GHz suggest a power-law dependence of solid-phase shear stress on strain rate. Novel nonequilibrium molecular dynamics simulations of plastic flow have been carried out. These steady-state isothermal calculations appear to be consistent with the present-day experimental data and suggest that the flows of metals can be described by a single physical mechanism over a range of strain rates from 10 kHz to 1 THz.

58760 Direct determination of sizes of excitations from optical measurements on ion-implanted GaAs. Aspnes, D.E.; Kelso, S.M.; Olson, C.G.; Lynch, D.W. (Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **48**: No. 26, 1863-1866(28 Jun 1982). Contract W-7405-ENG-82.

Using a simple model that describes the decrease of the amplitudes of optical structures in ion-implanted crystals, projected areas of several valence and core excitons in GaAs are determined. The last remnant of crystal-related optical structure vanishes for crystallite areas less than $(16\ A)^2$.

58761 Hexatic order and herring-bone packing in liquid crystals. Bruinsma, R.; Aeppli, G. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **48**: No. 23, 1625-1628(7 Jun 1982). Contract AC02-76CH00016.

A model is proposed for coupling bond-orientational and herring-bone packing degrees of freedom in layered liquid crystals. Three distinct phases are possible: isotropic, and bond-orientationally ordered stacked hexatic with and without herring-bone order. The transition between the two ordered phases is first order. The isotropic-hexatic transition can be driven first order by fluctuations and becomes second order at a tricritical point. Available experimental data are consistent with our model.

58762 Universal behavior of exchange-correlation energy in electron-hole liquid. Vashishta, P.; Kalia, R.K. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **25**: No. 10, 6492-6495(15 May 1982). Contract W-31-109-ENG-38.

Exchange-correlation energy of electron-hole liquid (EHL) is shown to be independent of different band characteristics of semiconductors. A simple expression of ϵ/sub xc/ for EHL in all semiconductors is given. In units of excitonic rydberg, ϵ/sub xc/ = (a+br/sub s/)/(c+dr/sub s/+r^2/sub s/), where a = -4.8316, b = -5.0879, c = 0.0152, and d = 3.0426. Ground-state and thermodynamic properties calculated with this expression are in good agreement with earlier theoretical calculations and experimental results.

58763 Surface plasmon dispersion on a single-sheeted hyperboloid. Becker, R.S.; Anderson, V.E.; Birkhoff, R.D.; Ferrell, T.L.; Ritchie, R.H. (Oak Ridge National Lab., TN). *Canadian Journal of Physics;* **59**: No. 4, 521-529(1981). Contract W-7405-ENG-26.

The surface-plasmon dispersion relation is obtained for a single-sheeted hyperboloid of revolution. The effects of retardation are neglected, and the electric potential is obtained from Laplace's equation in oblate spheroidal coordinates. Our results are applicable to the description of eigenmodes for a submicron hole in a material which may be supposed to have a local dielectric function.

58764 Surface crystallography by low-energy electron diffraction. Somorjai, G.A.; Kesmodel, L.L. (Lawrence Berkeley Lab., CA). *Transactions of the American Crystallographic Association;* **13**: No. 67, 67-99(1977).

A review of the state of the art in LEED surface crystallography is given. The main features of the theory, the important physical parameters that enter and the most widely used method of surface structure analysis are outlined. Then what has been learned by LEED about the structure of clean solid surfaces and of adsorbates on these surfaces that was not known 10 years ago is reviewed. Finally, several directions of future research is pointed out.

6561 Superconductivity

REFER ALSO TO CITATION(S) 57304, 57305, 57382, 57390, 57397, 57399, 57462, 57526, 57531, 57533

58765 (HU-TFT—81-24) Supercurrents of ^{3}He-A in narrow pores: end effects. Thuneberg, E.V.; Kurkijaervi, J. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 29 May 1981. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702701.

We study supercurrents of ^{3}He-A through narrow pores and find such currents to vanish in many cases because of end effects at the entries and exits of the pores. Under constant pressure DC-supercurrents are found to arise. We also consider the effects of finite frequencies on the end effects.

58766 Development of in situ formed Nb_3Sn-Cu superconducting wire. Sue, J. Ames, IA; Iowa State Univ. (1981). 75p. University Microfilms Order No.81-28,864.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Flux pinning and the optimization of J/sub c/ properties have been studied for in situ prepared Nb_3Sn-Cu superconducting composite wire. The pinning force density is found to be a universal function of magnetic fields as F/sub p/ proportional to H/sup 1/2/$(1-h)^2$ over the full range of reduced field density, h, from h = 0.1 to h = 1.0. The experimental results for a wide range of microstructures show that J/sub c/ is controlled by core pinning on surfaces of grain boundaries, and pinning by shear forces in flux line lattice at high fields is not important. The effective pinning area per unit volume calculated from theory is found to be equal to the area of the interfaces of Nb_3Sn-Nb_3Sn grain boundaries which are perpendicular to the filament axis. An attempt to increase J/sub c/ properties in these wires is made by eliminating C impurities, optimizing as-drawn Nb filament size, and alloying with the third element Ta. J/sub c/ is increased by a factor of 2 to 5 by reducing C content in the alloy from 380 ppmw to 15 ppmw. Optimum Nb filament thicknesses to produce maximum J/sub c/ and H/sub c2/* are found to be 600 A and 700 A for 550°C diffusion annealing and 650°C diffusion annealing, respectively. In addition, Ta additions in the alloy lead to an increase of J/sub c/ at magnetic fields above 12T. It is found that a small amount of Ta in composite wire can raise H/sub c2/* as well as J/sub c/.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 57804

58767 (CNRS-CPT—81-P-1317) **Density of states for almost periodic Schroedinger operators and the frequency module: a counter-example.** Bellissard, J.; Scoppolla, E. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jul 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702226.

We exhibit an example of a one-dimensional discrete Schroedinger operator with an almost periodic potential for which the steps of the density of states do not belong to the frequency module. This example is suggested by the K-theory.

58768 (CNRS-CPT—81-P-1323) **Statistical equilibrium and symplectic geometry in general relativity.** Iglesias, P. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1981. 12p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701960.

A geometrical construction is given of the statistical equilibrium states of a system of particles in the gravitational field in general relativity. By a method of localization variables, the expression of thermodynamic values is given and the compatibility of this description is shown with a macroscopic model of a relativistic continuous medium for a given value of the free-energy function.

58769 (CPT—81/P-1318) **CP_1 model on the torus: contribution of instantons.** Richard, J.L.; Rouet, A. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jul 1981. 25p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82904586.

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The contribution of instantons to the partition function is calculated for the two-dimensional CP_1 model defined on the torus.

58770 (EEC—115) **Work and heat in the light of (thermal and laser) light.** Laufer, G. (Technion-Israel Inst. of Tech., Haifa. Energy Engineering Center). Aug 1981. 5p. NTIS (MF) (US Sales Only). Order Number DE82903469.

Portions of document are illegible.

The definitions of work and heat and the relation between these quantities and energy is reviewed. Three expositions are considered and their validity for thermodynamical nonequilibrium processes is examined by applying them to hypothetical experiments where light is made to interact with absorbing systems. The Caratheodory exposition in contrast to the other expositions properly classifies laser interaction with absorbing matter as a work interaction.

58771 (EFI—484(27)-81) **Vacuum polarization by invariant sources.** Ananikian, N.S.; Savvidy, G.K. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702227.

Vacuum polarization by invariant sources generating the vacuum expectation of classical action S has been studied. The variational method is used for finding out matrix elements. The method essence consists in constructing the effective potential dependent on the matrix elements. The variational problem is formulated and a set of equations determining GITA(PHI, S) is written out. Perturbation theory for GITA is constructed. The problems concerning the renormalization of GITA are discussed.

58772 (IC—79/13) **Comparison, existence, uniqueness and successive approximations for ordinary and elliptic boundary value problems.** Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702490.

Bailey, Shampine and Waltman have developed an existence theory for two-point boundary value problems of second-order differential equations whose second members satisfy one-sided Lipshitz conditions. These results suggest that solutions should exist in the following much more general situation: the second member f is bounded by two functions f_1, f_2, such that the corresponding second-order equations have solutions for two-point boundary value problems. The condition $f_1 <= f <= f_2$ implies that if xsub(i) is a solution of the Picard problem xsub(i)″ = fsub(i)(t, xsub(i)), xsub(i)(a) = A, xsub(i)(b) = B, then x_2 and x_1 are, respectively, a lower and an upper solution of the Picard problem x″ = f(t,x), x(a) = A, x(a) = A, x(b) = B. Then a well-known result would imply an affirmative answer to our conjecture if $x_2 <= x_1$. The aim of this paper is to provide a comnparison result and to apply it to uniqueness and existence of solutions as well as to the convergence of successive approximations. The argument is so general that it applies to (i) periodic solutions of first-order ordinary differential equations; (ii) periodic solutions and a large class of Sturm-Liouville problems (including Nicoletti boundary value problem) for second-order ordinary differential equations; and (iii) Dirichlet boundary value problems for elliptic equations.

58773 (IFVE-OTF—81-49) **Collective coordinates on symplectic manifolds.** Razumov, A.V.; Taranov, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701849.

For an arbitrary Lie group of canonical transformations on a symplectic manifold collective coordinates are introduced. They describe a motion of the dynamical system as a whole under the group transformations. Some properties of Lie group of canonical transformations are considered.

58774 (IFVE-OTF—81-91) **Trigonometric and Ssub(N)-symmetric solutions of triangle equations with variables on the faces.** Bazhanov, V.V.; Stroganov, Yu.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702235.

General properties of triangle equations with variables on faces are discussed. The solution of triangle equations is a main point for study of different problems in quantum mathematical physics. A simple method to search for the solutions of these equations is offered. The statistical vertex model is formulated. The unitarity and crossing symmetry conditions are derived. Solutions of triangle equations for Ssub(N)-symmetric model are obtained.

58775 (IFVE-OTF—81-102) **Homogeneous point canonical transformation in the path integral.** Storchak, S.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701961.

For the homogeneous point canonical transformations in the path integral the method not based on discrete approximation is proposed. The way in which one must change the supplementary condition that fixes the self-adjoint extension of the Hamilton operator in the initial path integrals is shown.

58776 (IFVE-OTF—81-141) **Einstein formula for gravitation radiation is not a consequence of the general relativity theory.** Vlasov, A.A.; Denisov, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701962.

In the paper it has been shown that the intensity of gravitational radiation and total intensity, defined in the general relativity theory GRT according to Einstein, depend on the choice of a coordinate system. As a result they may turn into zero, and even more, become negative. Therefore the well known Einstein quadrupolar formula, usually used in GRT for calculations, is not a consequence of the GRT and is not contained in it. This result is a particular consequence of a general statement about absence of energy-momentum conservation laws of a system, consisting of matter and gravitational field, in GRT.

58777 (INIS-mf—6968, pp 172-179) **Semiclassical dynamics.** Balazs, N.L. (New York Univ., NY (USA). Dept. of Physics). 1979. NTIS (US Sales Only), PC A18/MF A01.

From Conference on large amplitude collective nuclear motion; Lake Balaton, Hungary (10 Jun 1979).

It is pointed out that in semiclassical dynamics one is encouraged to study the evolution of those curves in phase space which classically represent ensembles corresponding to wave functions. It is shown that the fixed points generate new time scales so that for times longer than the critical times, quantum dynamics will profoundly differ from classical dynamics.

58778 (INS—408) Quantum theory of collective motion: quantized self-consistent collective-coordinate method for the large-amplitude nuclear collective motion. Marumori, T.; Sakata, F.; Une, T.; Hashimoto, Y.; Maskawa, T. (Tokyo Univ. (Japan). Inst. for Nuclear Study). Apr 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903655.

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This is the third in a series of papers which intends to develop a new microscopic theory capable by itself to determine the maximal-decoupled collective subspace in the many-particle Hilbert space as well as the collective Hamiltonian specifying the subspace. The fundamental principle to formulate the theory is called the invariance principle of the Schroedinger equation. The main purpose of this paper is to show that, when we positively utilize the invariance principle, we can directly obtain a quantum theory of collective motion going beyond the random phase approximation.

58779 (ITEF—82(1980)) "Asymptotic freedom" in quantum mechanics. Vajnshtejn, A.I.; Zakharov, V.I.; Novikov, V.A.; Shifman, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702237.

Sum rules in quantum mechanics true for nonsingular potentials are considered. The physical content of sum rules is reduced to the fact that at small distances the interaction energy is small as compared with kinetic energy and the interaction may be considered as perturbation. In this sense there exists a direct analogy with quantum chromodynamics sum rules, previously discussed in detail. The common character of the situation found for the first time in the case of quantum chromodynamics: if the interaction grows fast with the distance increase one may obtain sum rules which on the one hand use Born approximation of interaction, on the other - they are saturated by one-two low levels.

58780 (JINR—E-2-81-449) 1/N-expansion for the anharmonic oscillator. Koudinov, A.V.; Smondyrev, M.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701851.

The properties of the 1/N-expansion for the anharmonic oscillator in quantum mechanics have been investigated. The first seven terms of the expansion for the energy of ground and first excited levels are obtained analytically. The high-order behaviour of the 1/N-expansion coefficients in closed form was found, the asymptotic series obtained being Borel summable. The formulae derived was used to find the first seven coefficients of the perturbative expansion in powers of the coupling constant in the case of the double-well potential for arbitrary number of components N. These exact expressions enable us to guess the large-order behaviour of the perturbative coefficients for N=0, 1, ... 4. An example of summing the asymptotic series in powers of 1/N applying the Pade-Borel method is given.

58781 (JINR—E-2-81-540) Nonlinear Schroedinger equation with U(p,q) isotopical group. 2. The U(1,1) system. Makhankov, V.G.; Pashaev, O.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701852.

The properties of the nonlinear Schroedinger equation (NLS) with U(1,1) isogroup are considered in detail. This example illustrates the essential difference between the system and the well-known "vector" NLS, i.e. the large set of allowed boundary conditions on the fields that leads to a rich set of solutions of the system. Four types of boundary conditions and related soliton solutions are considered. The Bohr-Sommerfeld quantization allows to interpret them in terms of "drops" and "bubbles" as bound states of a large number of constituent bosons subject to the thermodynamical relations for gas mixtures. The U(1,1) system under the vanishing boundary conditions may be considered as continuous analog of the Hubbard model and therefore the paper is concluded by studying the inverse scattering equations for this case.

58782 (JINR—E-2-81-609) Complex-potential description of the damped harmonic oscillator. Pt. 2. The one-dimensional case. Exner, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701964.

The propagator of multidimensional damped harmonic oscillator described by a non-selfadjoint Hamiltonian with complex potential was found earlier. The one-dimensional case is treated in detail with the following results. The non-damped limit gives correct propagator including Maslov phase factor. For some initial conditions, classical limit of the solution can differ from the behaviour of the classical damped oscillator, the difference being negligible in the case of weak damping. Point spectrum of the considered pseudo- Hamiltonian is found.

58783 (JINR—R-2-81-31) Lax representation for nonlinear evolution equations. Nesterenko, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702494.

It is shown by the methods of classical differential geometry that in case of two independent variables the nonlinear equation in frequency derivatives of the second order of general type can be presented in operator Lax form. Linear equations describing alternation of mobile reper during movement of its beginning along the integral surface of the initial nonlinear equation are used as operators. The problem of introducing spectral parameter into Lax representation is discussed.

58784 (JINR—R-2-81-403) Analog of the Feynman-Gell-Mann equation for a spin 1 charged particle. Leonovich, A.A.; Pestov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701853.

A relativistic wave equation is proposed for a spin 1 charged particle. The wave function of such a particle is represented by a self-dual antisymmetric tensor of second rank. The equation proposed is analogous to the known Feynman- Gell-Mann equation for spin 1/2 particles. An exact solution is obtained for the problems of motion in the Coulomb field, in the field of a plane electromagnetic wave and in the uniform magnetic field.

58785 (JINR—R-2-81-466) Extension of the Einstein space classification to N=1 supergravity. Kalitsin, S.N.; Ogievetskij, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702241.

In N=1 supergravity the Weyl tensor and the spin-vector field strength are incorporated in the same supermultiplet. Respectively, the Petrov-classification of the Weyl tensor, yields some conditions on the gravitino field strength. These constraints are especially simple for the degenerate types and in a linearised approximation, having there a simple interpretation.

58786 (JINR—R-5-81-372) Polyspheroidal wave functions. Truskova, N.F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701854.

Necessary in a number of physical problems solutions of Helmholtz equation in coordinate system of N-dimensional (N>=4) rotation ellipsoids and hyperboloids are obtained. These solutions are expressed via new special functions which particular cases are spheroidal and hyperspheroidal functions. Analytical expressions are found and main properties of new functions are considered.

58787 (KFTI—80-50) **Electromechanical instability of oscillatory circuit in external electromagnetic field.** Moskovchenko, I.V.; Repalov, N.S.; Sidorenko, I.S. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1980. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701837.

6 refs.; 3 figs.; 1 tab.

Electromechanical vibrations of the elastic oscillatory circuit placed in an external electromagnetic field caused by the effect of the reserved in the circuit of electromagnetic energy on its radiochemical parameters are considered. The purpose of the study has been to obtain qualitative and quantitative characteristics of the electromechanical vibrations process. The system of two nonlinear equations describing electromechanical processes in the circuit has been solved by the method of solution expansion in a series by the small parameters. In static approximation obtained are the nonlinear oscillation resonance curve equation as well as relations determining the critical parameters of the circuit and its supply system at which electromechanical vibrations are possible. The self-excited oscillation mode and the problem on circuit oscillation stability are considered.

58788 **(PM—81/10) Completion theorem relative to one-dimensional Schroedinger equations with energy-dependent potentials.** Jean, C. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). Oct 1981. 34p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82904245.

Portions of document are illegible.

58789 **(PM—81/12) Generalization of IST via asymptotically oscillating potentials.** Leon, J.J.P. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82904091.

We study the inverse spectral transform (IST) for a Dirac equation in which the potentials possess x and t-dependent asymptotic behaviors. The result of IST provides a new set of solutions of the same class of nonlinear evolution equations as that obtained previously for the standard Dirac equation. It is shown that such new solutions are obtained when assuming for the spectral data a certain type of nonisospectral evolution.

58790 **Resonances and analyticity of scattering wave function for square-well-type potentials.** Weber, T.A.; Hammer, C.L.; Zidell, V.S. (Ames Laboratory—DOE and Department of Physics, Iowa State University, Ames, Iowa 50011). *American Journal of Physics;* **50**: No. 9, 839-845(Sep 1982). Contract W-7405-ENG-82.

In this paper we extend our previous analysis of the scattering of wave packets in one dimension to the case of the square-well potential. The analytic properties of the general scattering solution are emphasized thereby making the analysis useful as introductory material for a more sophisticated S-matrix treatment. The square-well model is particularly interesting because of its application to the deuteron problem. Resonance scattering, barrier penetration, time delay, and line shape are discussed at the level of the first-year graduate student.

58791 **Electron momentum modulation by the stimulated Cerenkov interaction.** Kimura, W.D. (Stanford University, Stanford, California 94305). *Journal of Applied Physics;* **53**: No. 8, 5435-5439(Aug 1982).

Momentum modulation of relativistic electrons by laser light using the stimulated Cerenkov interaction is analyzed. This interaction is accomplished by introducing a gas whose index of refraction retards the phase velocity of the light wave. By intersecting the electron and laser beams at the Cerenkov angle, θ/sub c/ = $\cos^{-1}(1/n\beta)$, where n is the index of refraction of the gas, and β is the ratio of the electron velocity over the velocity of light in vacuum; the electrons remain in a field of constant phase resulting in a cumulative energy exchange. The laser-induced change in particle momentum and the electron beam energy spectrum are analyzed as a function of the electron and laser-beam characteristics. The results agree with a computer simulation of the interaction.

58792 **Einstein gravity as a symmetry-breaking effect in quantum field theory.** Adler, S.L. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Reviews of Modern Physics;* **54**: No. 3, 729-766(Jul 1982). Contract AC02-76ER02220.

This article gives a pedagogical review of recent work in which the Einstein-Hilbert gravitational action is obtained as a symmetry-breaking effect in quantum field theory. Particular emphasis is placed on the case of renormalizable field theories with dynamical scale-invariance breaking, in which the induced gravitational effective action is finite and calculable. A functional integral formulation is used throughout, and a detailed analysis is given of the role of dimensional regularization in extracting finite answers from formally quadratically divergent integrals. Expressions are derived for the induced gravitational constant, for the induced cosmological constant, and for quantized matter theories on a background manifold, and a strategy is outlined for computing the induced constants in the case of an SU(n) gauge theory. By use of the background field method, the formalism is extended to the case in which the metric is also quantized, yielding a derivation of the semiclassical Einstein equations as an approximation to quantum gravity, as well as general formulas for the induced (or renormalized) gravitational and cosmological constants.

58793 **Chaotic attractors in crisis.** Grebogi, C.; Ott, E.; Yorke, J.A. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physical Review Letters;* **48**: No. 22, 1507-1510(31 May 1982). Contract AC02-76ER03075.

The occurrence of sudden qualitative changes of chaotic (or "turbulent) dynamics is discussed and illustrated within the context of the one-dimensional quadratic map. For this case, the chaotic region can suddenly widen or disappear, and the cause and properties of these phenomena are investigated.

58794 **Quantum solution of the Calogero system by the projection method.** Gipson, J.M. (J. W. Gibbs Laboratory, Physics Department, Yale University, New Haven, Connecticut 06511). *Physical Review Letters;* **48**: No. 22, 1511-1514(31 May 1982). Contract AC02-76ER03075.

The projection method is a constructive proof of complete integrability of classical many-body systems. This method is extended to the quantum case. The wave functions and propagators of the n-particle Calogero systems are given in the form of integrals involving the wave functions and propagators of free motion in a space of n^2 dimensions. Quantization of angular momentum in the large space yields solutions for discrete values of the coupling constant.

58795 **Nonconventional optical systems and brightness theroem.** Welford, W.T.; Winston, R. (Imperial College, Blackett Laboratory, London, SW7 2BZ, U.K.). *Applied Optics;* **21**: No. 9, 1531-1533(1 May 1982).

The brightness on radiance theorem in geometrical optics is reviewed and restated according to the laws of physics. (AIP)

58796 **Large N limits as classical mechanics.** Yaffe, L.G. (California Institute of Technology, Pasadena, California 91125). *Reviews of Modern Physics;* **54**: No. 2, 407-435(Apr 1982). Contract AC03-76ER00068.

This paper discusses the sense in which the large N limits of various quantum theories are equivalent to classical limits. A general method for finding classical limits in arbitrary quantum theories is developed. The method is based on certain assumptions which isolate the minimal structure any quantum theory should possess if it is to have a classical limit. In any theory satisfying these assumptions, one can generate a natural set of generalized coherent states. These coherent states may then be used to construct a classical phase space, derive a classical Hamiltonian, and show that the resulting classical dynamics is equivalent to the limiting form of the original quantum dynamics. This formalism is shown to be applicable to the large N limits of vector models, matrix models, and gauge theories. In every case, one can explicitly derive a classical action which contains the complete physics of the $N = \infty$ theory. "Solving" the $N = \infty$ theory requires minimizing the classical Hamiltonian, and this has been possible only in simple theories. The relation between this approach and other methods which have been proposed for deriving large N limits is discussed in detail.

58797 Network loading of thin-wire antennas and scatterers in the time domain. Landt, J.A. (Los Alamos National Lab., NM). *Radio Science;* **16**: No. 6, 1241-1247(Nov 1981).

A numerical technique is presented that is capable of calculating the transient response of a thin-wire antenna or scatterer loaded by a network. The electromagnetic formulation is an adaptation of a well-validated and widely used code. This code is based on an electric field integral equation and employs point matching and nine-point Lagrangian interpolation functions. The network is treated by a nodal analysis and can contain a finite number of lumped and possibly nonlinear elements. The formulation is cast in the time domain, and the solution is obtained by a time-stepping procedure. The numerical approach is outlined, and the responses of several examples are presented.

58798 Radiative transfer in spectrally-dissimilar absorbing-emitting-scattering adjacent mediums. Im, K.H.; Ahluwalia, R.K. (Argonne National Laboratory, Argonne, IL). pp 11p, Paper 81-1091 of 16th thermophysics conference. Los Angeles, CA; American Institute of Aeronautics and Astronautics (1981). Contract W-31-109-ENG-38.

From 16. thermophysics conference; Palo Alto, CA, USA (23 Jun 1981).

The structure of a radiation field in a cylindrical medium having two regions of different, but uniform absorption and scattering coefficients is analyzed. Fundamental aspects of the problem are elucidated by considering the case of a gray medium. It is shown for example that, for unequal absorption coefficients in the two regions, both emission and absorption rates are discontinuous at the interface of the two regions, but the heat flux and incident radiation are continuous. As an application of the analysis, the influence on heat transfer of the spatial distribution of particles in a coal-burning swirl combustor is investigated. In the example application, spectral calculations are performed spanning the broad frequency range of the thermal radiation spectrum.

58799 Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979). 550p. (CONF-790529—).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

The Conference focused on optical components, optics for laser fusion, laser and detectors, and applications of optics in diagnostics. Papers were given on holographic optical elements, a laser beam expander, multi-terawatt CO_2 laser fusion systems, Helios beam diagnostics, the Antares beam alignment system, an optically pumped CF_4 laser system, multipulse energy extraction in CO_2 laser amplifiers, fiber optics applications in plasma diagnostics, phase conjugation on CO_2 lasers, high power gas lasers and spectroscopy, and interferometry and applications to optical testing.

58800 Scattered-light measurements of optical surfaces. Smartt, R.N. (Sacramento Peak Observatory, Sunspot, NM). pp 58-66 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

Measurements of the angular distribution of scattered light produced by specially-polished optical components are reported. The components were six 12-cm aperture coronagraph objective mirrors and two 20-cm coronograph objective lenses. For each test the component was illuminated with white light and the magnitude of the scattered flux measured at several field points. It was not feasible to separate surface and body scattering of the lenses, so that these measurements represent the combined contributions. Successive recoatings and tests of the mirrors has led to the conclusion that the residual roughness of the substrate polish is the dominant parameter that determines the magnitude of the scattered flux. Dark ground and phase contrast measurements qualitatively support this conclusion. The fractional contributions of integrated scattered light of the lenses and mirrors are found to be of the same order, although the functional relationships are significantly different over the angular range measured.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 57817, 58349, 58545, 58736

58801 (CEA-N—2257) Boltzmann equation in 1D-spherical and cylindrical geometry. Specifications of the ORPHEE code. Verwaerde, D. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1981. 66p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702223.

Specifications of ORPHEE (a neutronic time-independent code for 1D-spherical or cylindrical-geometry) are given. The various forms of Boltzmann's equation, with respect to the kind of symmetry are presented. The development of the anisotropic source is studied and then it is shown how to build finite difference schemes in order to get a good approximation of this equation.

58802 (CNRS-CPT—81-P-1311) Almost periodic Hamiltonians: an algebraic approach. Bellissard, J.; Testard, D. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jul 1981. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702224.

We develop, by analogy with the study of periodic potential, an algebraic theory for almost periodic Hamiltonians, leading to a generalized Bloch theorem. This gives rise to results concerning the spectral measures of these operators in terms of those of the corresponding Bloch Hamiltonians.

58803 (IC—79/9) Priori bounds for solutions of two-point boundary value problems using differential inequalities. Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702233.

Two point boundary value problems for systems of differential equations are studied with a new approach based on differential inequalities of first order. This leads to the following results: (i) one-sided conditions are enough, in the sense that the inner product is substituted to the norm; (ii) the upper bound exists for practically any kind of equations and boundary value problem if the interval is sufficiently small since it depends on the Peano existence theorem; (iii) the bound seems convenient when the equation has some singularity in t as well as when sigular problems are considered.

58804 (IC—79/10) Existence of positive solutions for non-linear elliptic equations. Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702228.

The author proves some theorems concerning the existence of positive solutions of the elliptic Dirichlet problem $L(u) = f(x,u)$, $u/\Delta\Omega\Xi 0$ where $f(x,u) >= 0$ for $u> = 0$.

58805 (IC—79/11) Comparison, existence, uniqueness and successive approximations for two-point boundary value problems. Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702229.

Bailey, Shampine and Waltman developed an existence theory for two-point boundary value problems of second order differential equations whose second members satisfy one-sided Lipschitz conditions. It is suggested that solutions should exist in a much more general situation. A comparison result is given and applied to uniqueness and existence of the Picard problem as well as to the convergence of successive approximation for this.

58806 (IC—79/12) **Two remarks on the stability of ordinary differential equations.** Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702230.

In this note the definition of Liapunov functions is extended, obtaining a generalization of the recent result by Lakshmikantham and Leela on the perturbation of Liapunov functions, and two sufficient conditions for the solvability of Olech's problem on global stability are pointed out.

58807 (IC—79/14) **Two fixed-point theorems related to eigenvalues with the solution of Kazdan-Warner's problem on elliptic equations.** Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702231.

The paper presents a proof of two fixed-point theorems, which unify previous results on periodic solutions of second-order ordinary differential equations, in the sense that the existence part of these solutions become a corollay of the fixed-point theorems.

58808 (IC—79/15) **Existence and uniqueness results for boundary value problems from the comparison of eigenvalues.** Vidossich, G. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1979. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702232.

The paper treats the existence and uniqueness of solutions for nonlinear boundary value problems by comparing, in a suitable way, the nonlinear term with the eigenvalues of the linear part.

58809 (JINR—E-2-81-604) **Complete set of highest-weight representation for SL(3,C).** Burdik, C.; Havlicek, M.; Exner, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701963.

Infinite-dimensional highest-weight representations (HWRs) of sl(3, C) are constructed using canonical (boson) realizations of this algebra. The method applies to all weights except for the cases in which the irreducible HWRs are finite-dimensional. The obtained representations are irreducible and such that matrix elements of their generators are easily calculated.

58810 (JINR—R-2-81-633) **Correction of the fermion Green function.** Duong Van Phi; Nguen Mong Giao. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701966.

The formalism of interaction field theory in the unified space is used to calculate the correction of the fermion Green function in the fourth order of perturbation theory. The result is finite. It is applied to correct the matrix element of the Compton effect. For this purpose the unitarity condition is also proved.

58811 (LRP—179/80) **Numerical solution to a continuity equation.** Vittoz, J.C.; Appert, K.; Muschietti, L. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). Dec 1980. 32p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903474.

A study is made of the properties of numerical solutions which result in the integration of a continuity equation with the aid of Lagrange type third degree finite elements. The adjunction of a small artificial diffusion term is shown to diminish substantially the phase errors inherent in discretization. Following optimization, such a method approaches the performance of a simple F.C.T. diagram. 10 references, 8 figures.

58812 **Korteweg-de Vries surfaces and Baecklund curves.** Kupershmidt, B.A. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Journal of Mathematical Physics (New York);* **23**: No. 8, 1427-1432(Aug 1982).

It is shown that every point $w(\epsilon)$ on the curve γ/sub r/ (ϵ) representing a 1-parameter family of integrable equations containing a given rth Korteweg—de Vries (KdV) equation w(0), also belongs to a different integrable curve Γ/sub r/(ϵ,ν) . Symmetries of the resulting surface make it possible to construct a curve of Baecklund transformations, that is, infinitesimal automorphisms, of points on γ/sub r/ (ϵ) starting with the usual infinitesimal automorphisms of w(0). In addition, we obtain four new Baecklund transformations of the second order for all higher KdV equations.

58813 **Analysis of Taylor's theory of toroidal plasma relaxation.** Faber, V.; White, A.B. Jr.; Wing, G.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Mathematical Physics (New York);* **23**: No. 8, 1524-1537(Aug 1982).

The Taylor theory of toroidal plasma relaxation is considered as a nonlinear eigenvalue problem. The analysis is rigorous and applies to quite general toroidal cross sections. Emphasis is placed on the symmetric state case, where the existence of field reversal and flux free states is demonstrated. Certain anomalies are revealed by the mathematical treatment and their significance is studied. Existence of a solution to the Taylor problem in the symmetric state is proved and the location of the eigenvalue of this solution state relative to other states is examined. The question of the existence of helical states is not resolved, but it is shown that in many respects any helical states behave like the anomalous cases in the symmetric problem and hence do not significantly affect the theory.

70 FUSION ENERGY

58814 (DOE/ER—0132) **Technology spin-offs from the magnetic fusion energy program.** (Department of Energy, Washington, DC (USA)). May 1982. 167p. NTIS, PC A08/MF A01. Order Number DE82016923.

A description is given of 138 possible spin-offs from the magnetic fusion program. The spin-offs cover the following areas: (1) superconducting magnets, (2) materials technology, (3) vacuum systems, (4) high frequency and high power rf, (5) electronics, (6) plasma diagnostics, (7) computers, and (8) particle beams. (MOW)

7001 Plasma Research

REFER ALSO TO CITATION(S) 57896, 58397, 58989, 59030, 59031, 59036, 59036

58815 (AD-A—108799/8) **Level shifts and inelastic electron scattering in dense plasmas. Memorandum report.** Davis, J.; Blaha, M. (Naval Research Lab., Washington, DC (USA)). 10 Dec 1981. 35p. (NRL-MR—4689). NTIS, PC A03/MF A01.

A completely quantum mechanical formalism has been developed to describe the high density plasma effects on fundamental atomic parameters. Both the bound and free electrons are treated by a method which in principle is similar to Hartree's self-consistent field method. The free plasma electrons' wave-function is obtained from the Schrodinger equation with the effective potential representing the spherically averaged Coulomb interaction with bound and free electrons. Results are given for level shifts, coefficients of transition probabilities, and electron collision cross sections of Ne(9+) for temperature and 200 and 500 e V for an electron density range of 1 - 6 x 10 to the 24th power/cc, and of Ar(17+) for temperatures of 1000 and 2000 eV and electron densities from 2 x 10 to the 25th power to 8 x 10 to the 25th power/cc. In the low-density region, level shifts are obtained for H and He+.

58816 (AD-A—109041/4) **The cavity Q for ergodic eigenmodes. Memorandum report.** Ott, E.; Manheimer, W.M. (Naval Research Lab., Washington, DC (USA)). 22 Dec 1981. 8p. (NRL-MR—4641). NTIS, PC A02/MF A01.

We consider here the problem of calculating the Q of a very overmoded, (wavelength $<<$ cavity size) irregularly shaped resonant cavity due to absorption of the electromagnetic radiation at the walls. We assume further that the volume inside the cavity can be either vacuum, or else partially filled with anisotropic inhomogeneous dielectric or plasma. Both the scale length of the dielectric and the radius of curvature of the walls are assumed much larger than the radiation wavelength. However, near the cavity walls, a vacuum is assumed. Our main interest here is in applications concerning magnetically confined plasmas. For instance consider a tokamak containing a hot plasma which radiates at the cyclotron frequency and its harmonics. An important issue is how much of this cyclotron radiation is absorbed by the walls and how much is reabsorbed by the plasma. Generally this can be calculated with a ray tracing code where many rays are followed and the absorbtion and emission are calculated along each ray path. However if the plasma is optically thin, as it would be at the higher harmonics, and if the reflection coefficient at the wall is near unity the rays would have to be followed for long distances before one could see how much energy is deposited in the wall. In this paper we utilize the ergodic theorem to calculate the wall absorbtion for the case where the wave makes many bounces and before it is absorbed.

58817 **(AD-A—111349/7) Dynamics of a rotating proton layer along a magnetic ramp. Final report.** Golden, J.; Pasour, J.A.; Kapetanakos, C.A.; Marsh, S.J.; Pershing, D.E. (Naval Research Lab., Washington, DC (USA)). 31 Dec 1981. 57p. (NRL-MR—4699). NTIS, PC A04/MF A01.

The dynamics of a rotating proton layer containing 2 - 6 x 10 to the 16th power protons of 1 - 1.5 MeV energy propagating in vacuum along a ramp mangetic field have been studied experimentally and by computer simulation. The layer is produced by passing the annular proton pulse produced by an Inverse Reflex Tetrode (IRT) through a magnetic cusp. The diamagnetic self-magnetic field (as high as 1.6 times the applied field) and the radial oscillations of the layer are monitored. The axial velocity of the pulse is determined, and a maximum of 1.7 is obtained for the ratio of azimuthal to axial velocity. The layer has also been propagated along the ramp in the presence of a neutral gas cloud with pressure approximately greater than 0.1 Torr. Computer simulation of the experiment uses an axisymmetric particle-in-cell code that includes self- and external- Bz and Br magnetic fields and the inductive E theta electric field. Calculated contour maps of the particle and current densities of the beam at selected times are presented. The computer particle density profile, the ratio v theta/vz, and the magnitude of the diamagnetic signals are in qualitative agreement with the observations.

58818 **(AD-A—111508/8) On Kraichnan's 'direct interaction approximation' and Kolmogoroff's theory in two-dimensional plasma turbulence.** Kulsrud, R.M.; Sudan, R.N. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). Apr 1981. 12p. (LPS—293). NTIS, PC A02/MF A01.

The nonlinear damping in a strongly turbulent convecting plasma computed by Kraichnan's modified direct inteaction approximation and the power spectrum are rederived in a physically transparent form using Kolmogoroff's theory of turbulence.

58819 **(CEA-N—2242) Compendium of laser plasma interaction.** Bobin, J.L. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Oct 1981. 148p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82702261.

Basic mechanisms, linear and non linear, are reviewed. Absorption through inverse Bremsstrahlung, through wave-wave couplings; resonant absorption; wave breaking; ponderomotive force; harmonic generation; magnetic field generation. Subsequent plasma flows are described.

58820 **(CONF-810439—4) Method for obtaining electron energy-density functions from Langmuir-probe data using a card-programmable calculator.** Longhurst, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 6p. NTIS, PC A02/MF A01. Order Number DE82005270.

From 15. AIAA/JSASS/DGLR international electromagnetic propulsion conference; Las Vegas, NV, USA (21 Apr 1981).

This paper presents a method for obtaining electron energy density functions from Langmuir probe data taken in cool, dense plasmas where thin-sheath criteria apply and where magnetic effects are not severe. Noise is filtered out by using regression of orthogonal polynomials. The method requires only a programmable calculator (TI-59 or equivalent) to implement and can be used for the most general, nonequilibrium electron energy distribution plasmas. Data from a mercury ion source analyzed using this method are presented and compared with results for the same data using standard numerical techniques.

58821 **(CONF-811113—45) Deposition probe measurements of impurity and plasma fluxes near the wall in ISX-B.** Zuhr, R.A.; Roberto, J.B.; Withrow, S.P. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE82004062.

From American Vacuum Society national symposium; Anaheim, CA, USA (3 Nov 1981).

Portions of document are illegible.

It was shown that metallic impurity fluxes to the wall are far lower (x 3000) than those to limiter-like probes located 2 cm outside the limiter radius. Deuterium fluxes are also lower (x 10) at the wall position and are in reasonable agreement with single crystal silicon damage data. Finally, both wall and limiter position data are consistent with an impurity introduction model in which charge exchange neutral sputtering of the wall is the dominant introduction mechanism.

58822 **(DOE/DP/40016—T1) Low-frequency electric-microfield distributions in a plasma containing multiply-charged ions: extended calculations.** Tighe, R.J.; Hooper, C.F. Jr. (Florida Univ., Gainesville (USA). Dept. of Physics). 12 Nov 1976. Contract AS05-76DP40016. 23p. NTIS, PC A02/MF A01. Order Number DE82015634.

The formalism needed for the computation of electric microfield distributions in plasmas is extended as follows: (1) the perturbing ions and electrons in the plasma are allowed to have different kinetic temperatures; (2) two species of perturbing ions, of charge z_1 and z_2, may be present in any given proportion. Computed results are presented graphically for parameter ranges which are of interest in the study of laser-produced plasmas.

58823 **(DOE/DP/40016—T2) Study of stark broadening of high-Z hydrogenic ion lines in dense hot plasmas.** Tighe, R.J. (Florida Univ., Gainesville (USA). Dept. of Physics and Astronomy). 23 May 1977. Contract AS05-76DP40016. 259p. NTIS, PC A12. Order Number DE82015631.

Thesis.

Stark broadened x-ray line profiles from highly ionized hydrogenic ions, radiating while immersed in a hot dense plasma, are studied. The broadening effects produced by the ions present in the plasma are treated through the use of static electric microfield distribution functions. The microfield distribution functions employed have the following properties: (1) the radiating hydrogenic ion may have any net charge; (2) the perturbing ions and electrons in the plasma may have different kinetic temperatures; and (3) two species of ions, of charge z_1 and z_2, may be present in any given ratio.

58824 **(DOE/DP/40016—T3) X-ray line broadening as a diagnostic in laser-produced plasmas. Progress report.** Hooper, C.F. Jr. (Florida Univ., Gainesville (USA)). Jul 1978. Contract AS05-76DP40016. 4p. NTIS, PC A02/MF A01. Order Number DE82015633.

Research continues on developing theoretical formulations of spectral-line broadening (in plasmas) applicable to the diagnosis of pellet implosions. Numerous plasma-broadened Lyman profiles (α, β, γ) have been calculated for various ionic radiators, under a variety of plasma conditions. These are tabulated in the accompanying technical report. Corresponding tables of electric-modified-distribution functions are also included.

58825 **(DOE/DP/40016—T4) X-ray line broadening as a diagnostic in laser-produced plasmas.** Hooper, C.F. Jr.; Woltz, L.A. (Florida Univ., Gainesville (USA). Dept. of Physics and Astronomy). 1981. Contract AS05-76DP40016. 45p. NTIS, PC A03/MF A01. Order Number DE82015632.

A compilation is given of plasma-broadened Lyman-line profiles, and the corresponding ion-microfield distribution functions. (MOW)

58826 (DOE/ET/53047—19) **Confinement and heating of high-beta plasmas with emphasis on compact toroids. Task I. Annual report for period ending May 31, 1982.** Vlases, G.C.; Pietrzyk, Z.A. (Washington Univ., Seattle (USA). Dept. of Aerospace and Energetics Research). 1982. Contract AT06-76ET53047. 139p. (UWFPP—28). NTIS, PC A07/MF A01. Order Number DE82020186.

Portions of document are illegible.

Results are given for work during this period on each of the following areas: (1) spheromak production using conical theta pinch guns; (2) detection of CT fluctuation spectra via CO_2 forward scattering; (3) high density field reversal experiment; (4) plasma compression experiment; (5) material end plugging experiment; and (6) design of computerized data acquisition systems. (MOW)

58827 (EUR—6584(Vol.1), pp 3-17) **Neoclassical impurity transport.** Stringer, T.E. (JET Joint Undertaking, Abingdon (UK)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The neo-classical theory for impurity transport in a toroidal plasma is outlined, and the results discussed. A general account is given of the impurity behaviour and its dependence on collisionality. The underlying physics is described with special attention to the role of the poloidal rotation.

58828 (EUR—6584(Vol.1), pp 19-46) **Empirical approach to Tokamak transport.** Hawryluk, R.J. (Princeton University (USA)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This lecture present an overview of the important considerations related to particle and energy transport in a tokamak. Transport in tokamaks can be inferred by analyzing the experimental data in terms of the one dimensional magnetic field diffusion equation and the particle and energy conservation equations. This approach is illustrated by considering current penetration during the start up phase, density buildup in high density discharges, as well as the ion and electron energy balance in PLT ohmically heated discharges. Areas requiring further research will be discussed.

58829 (EUR—6584(Vol.1), pp 81-99) **Collisional transport in tandem mirrors.** Ryutov, D.D. (Institute of Nuclear Physics, Novosibirsk, USSR). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The absence of axial symmetry of Tandem Mirror devices results in some quite undesirable effects. Among them the least investigated one (and potentially most dangerous) is the influence of the distortions of the magnetic surfaces on resonant diffusion. The enhanced electron thermal conductivity due to the "non-omnigeneity" of drift trajectories in the end cells should also be a subject of concern. In the case of plasma with very low β it is possible to reduce these effects by appropriate tailoring of the magnetic field distribution in the transition regions. However, it is not quite clear whether this method will work for the practically interesting values of β. A more radical solution of these problems was suggested by TSEL'NIK (1978). It consists in using the entirely axisymmetric central cell and addition of two more short axisymmetric cells between the central cell and each of the end cells. By maintaining high plasma density in the intermediate cells one can create electrostatic barriers, while non-axisymmetric end cells will provide average minimum B. Of course, it is not quite clear whether this configuration will be MHD-stable at reasonable values of β. The final judgement on the real significance of the problems discussed here will come from the experiments on TMX, AMBAL-1 and other tandems.

58830 (EUR—6584(Vol.1), pp 101-127) **Anomalous transport in mirror systems.** Post, R.F. (Univ. of California, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

As now being explored for fusion applications confinement systems based on the mirror principle embody two kinds of plasma regimes. These two regimes are: a) High-beta plasmas, stabilized against MHD and other low frequency plasma instabilities by magnetic-well fields, but characterized by non-maxwellian ion distributions. b) Near-maxwellian plasmas, confined electrostatically (as in the tandem mirror) or in a field-reversed region within the mirror cell. Common to both situations are the questions of anomalous transport owing to high frequency instabilities in the non-maxwellian portions of the plasmas. This report will summarize the status of theory and of experimental data bearing on these questions, with particular reference to the high temperature regimes of interest for fusion power.

58831 (EUR—6584(Vol.1), pp 129-142) **Tearing modes in tokamaks.** Rutherford, P.H. (Princeton Univ., USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

It has been conclusively established by a variety of diagnostic techniques that low-m tearing modes occur in present-day tokamak devices. By acting as precursors to the disruptive instability, these modes serve to limit the parameter regime that can be obtained. In this lecture, the basic physics of tearing modes is reviewed, and the linear stability criteria for a number of tokamak current profiles are delineated. Optimum current profiles are discussed. On the basis of the energy available to drive $m=2$, $n=1$ and $m=3$, $n=2$ modes, the circumstances that can lead to strong disruptions can be identified. The role of electron cross-field viscosity in driving tearing modes is also discussed.

58832 (EUR—6584(Vol.1), pp 143-158) **Impurity-driven rippling modes in tokamaks.** Rutherford, P.H. (Princeton Univ., USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Rippling modes arising from nonuniformities in Zsub(eff) in an impure tokamak plasma are analysed: instabilities are found even in the case of large electron thermal conduction along field lines. For typical parameters, modes up to high m-values are unstable. The resulting magnetic perturbations, although small, could provide a mechanism for significant anomalous cross-field thermal transport.

58833 (EUR—6584(Vol.1), pp 159-179) **Nonlinear behavior of tearing modes.** Biskamp, D. (EURATOM-IPP Association, Garching (Germany, F.R.)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This lecture deals with the nonlinear properties of individual tearing modes. First the purely resistive case is considered. The nonlinear island growth is a slow diffusion process on the resistive skin time scale. The different effects determining the saturation island size are outlined. Tearing modes in a high temperature plasma are then discussed, where, in addition to resistivity, diamagnetic and viscous effects are important. Nonlinearly, however, these so-called drift tearing modes may behave quite similarly to purely resistive modes, since diamagnetic effects are quenched at a certain island size depending on the rate of cross-field plasma diffusion.

58834 (EUR—6584(Vol.1), pp 181-202) **Disruptive processes in tokamaks.** Biskamp, D. (EURATOM-IPP Association, Garching (Germany, F.R.)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This lecture reviews the theory of disruptive processes in tokamaks and similar devices, with particular emphasis on the internal $m=1$ disruption and the major $m=2$ disruption.

58835 (EUR—6584(Vol.1), pp 203-223) **What is the minimum value of the safety factor on the magnetic axis.** Bussac, M.N.; Pellat, R. (Ecole Polytechnique, Palaiseau, France); Edery, D.; Soule, J.L. (Association EURATOM-CEA, Fontenay-aux-Roses, France). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This paper is presented in the following way: in chapter 2 the main stability properties in the vicinity of the magnetic axis with respect to the localized modes is recalled. The possibility of decreasing the minimum value of the safety factor q below unity, without violating Mercier's criterion is emphasized. In chapter 3 the ideal internal kink in cylindrical geometry for non-circular cross-sections is studied. The main findings are the small destabilizing effect of an elliptical deformation and the larger stabilizing effect of a triangular deformation. In chapter 4 the previous analysis is completed by toroidal corrections and the complete result for the ideal internal kink for circular magnetic surfaces is given. This mode may be stable in toroidal geometry provided the minimum value of q remains larger than 1/2. In chapter 5 the resistive internal kink and its collisionless high temperature limit is discussed. Toroidal effects and non-linear effects in the non-linear development of the tearing modes are compared.

58836 (EUR—6584(Vol.1), pp 225-235) **Magnetohydrodynamic equilibria.** Nelson, D.B. (Office of Fusion Energy, Washington, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

MHD equilibria are reviewed, with emphasis on axisymmetric toroidal geometry. Effects of finite aspect ratio, finite β, and noncircular cross section are discussed. Required external confining fields are described, including those needed for cross section shaping. Transport and other time-dependent effects on equilibria are introduced, including the concepts of flux conserving tokamaks and resistive time equilibria.

58837 (EUR—6584(Vol.1), pp 237-269) **α-particles in tokamaks.** Pfirsch, D. (EURATOM-IPP Association, Garching (Germany, F.R.)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This talk covers the following topics: 1) generation of α-particles; 2) direct loss of α-particles, ripple effects; 3) losses during and after slow down of α-particles, transport code calculations, thermal instability, burning times; 4) ripple induced losses; 5) contribution of α-particles to the total pressure.

58838 (EUR—6584(Vol.1), pp 271-288) **Velocity space instabilities of alpha particles in tokamak reactors.** Sigmar, D.J. (Oak Ridge National Laboratory, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Of all species comprising the fusion plasma, the alpha particles have the strongest deviation from thermodynamic equilibrium, in configuration space as well as in velocity space. Under typical circumstances (main plasma density and temperature profile somewhat peaked and startup of the fusion burn not slower than an energy confinement time), the ensuing alpha gradients will lead to a low frequency drift-Alfven wave instability and the hollow alpha velocity distribution will lead to a high frequency compressional Alfven wave instability. This lecture will address the conditions for the linear theory and the anomalous relaxation of the velocity space instability of isotropic alpha distribution functions.

58839 (EUR—6584(Vol.1), pp 291-311) **Ignition with lower hybrid heating.** Brambilla, M. (Association EURATOM-CEA, Grenoble (France)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The feasibility of heating a large Tokamak plasma to ignition using Lower Hybrid waves is discussed. It is found that simple linear theory of coupling and absorption determines the frequency choice and the antenna design rather precisely. It also sets an upper limit to the plasma β at ignition which can be obtained with this method; it turns out to be compatible with reactor economic requirements. However, if non-linear scattering and absorption were to make the plasma considerably more opaque to LH waves than predicted by linear theory, ignition by LH heating might become impossible.

58840 (EUR—6584(Vol.1), pp 313-314) **Very low frequency plasma heating.** Canobbio, E. (Association EURATOM-CEA, Grenoble, France). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

58841 (EUR—6584(Vol.1), pp 315-337) **Electron cyclotron resonance heating of high temperature plasmas.** Antonsen, T.M. Jr.; Porkolab, M. (Massachusets Institute of Technology, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The heating of high temperature, magnetically confined plasma with electromagnetic radiation in the electron cyclotron frequency range is considered. An outline of the linear theory of propagation and absorption of electromagnetic waves is presented, and formulas for the absorption of the ordinary and extraordinary modes in an inhomogeneous magnetic field are given. Recent experimental results are outlined and the extension of current results to thermonuclear plasmas is discussed.

58842 (EUR—6584(Vol.1), pp 339-354) **Global properties of ohmically heated reversed-field pinches.** Gerwin, R.A. (Los Alamos Scientific Laboratory, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The simultaneous requirements of power balance and pressure balance have been considered. The treatment generalizes the Pease-Braginskii pinch current limit by including toroidal magnetic field, anomalous resistivity, nonradiative losses, and time-dependent fields. The rise of the temperature to a state of power balance proves to be amenable to a very simple and unified description. Finally, the practical parameter windows implied by the joint action of power balance and pressure balance are displayed.

58843 (EUR—6584(Vol.1), pp 355-358) **Compressional heating.** Duechs, D. (EURATOM-IPP Association, Garching, Germany, F.R.). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

58844 (EUR—6584(Vol.1), pp 359-371) **Neutral injection heating of toroidal plasma to ignition.** Cordey, J.G. 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The basic theory of the neutral injection heating of a toroidal plasma is presented. This consists of the deposition of the fast ions, their energy loss, scattering and radial diffusion, followed by the effect of this method of heating on the plasma temperature, current and rotation, and the production of α particles. Special emphasis will be placed on problem areas which may prevent ignition being achieved. In particular the subject of the injection energy and power level required to reach ignition with different scaling laws will be discussed.

58845 (EUR—6584(Vol.1), pp 373-392) **Energy deposition profiles in fast neutral injection experiments.** Dei-Cas, R. (Association EURATOM-CEA, Fontenay-aux-Roses, France). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

A Monte Carlo code has been developed to calculate the beam energy deposition profile in real geometry experiments including the ripple trapping effects. The computation time has been drastically reduced by using an acceleration process which conserves the physical aspects. Applications will be given for TFR and an ignitor-like experiment.

58846 (EUR—6584(Vol.1), pp 395-410) **Radiation in thermonuclear regime.** Griem, H.R. (University of Maryland, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Processes to be considered in addition to the irreducible electron-(D or T) ion bremsstrahlung are line radiation from incompletely stripped impurity ions, recombination radiation and bremsstrahlung on these ions and higher harmonics of the electron cyclotron radiation. The impurity radiation processes depend strongly on the charge state of the ions which is, besides by transport, usually controlled by electron impact ionization and electron capture with excitation (dielectronic recombination). Rate coefficients for these processes and for electron impact excitation of line radiation are estimated and basic formulas for bremsstrahlung, recombination radiation, and cyclotron harmonic emission are reviewed. Comparison is made with rate coefficients used in calculations of impurity radiation from plasmas for which corona equilibrium can be assumed.

58847 (EUR—6584(Vol.1), pp 411-418) **2.g. ionization, recombination and radiation barriers.** Griem, H.R. (University of Maryland, USA). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Because of the intense line radiation from low ionization stages of a given element, it is important that ionization is rapid and effective even at relatively low electron densities, i.e., occurs relatively early in the discharge and reasonably close to the boundary. These requirements lead for given electron impact ionization rates to upper bounds on impurity fluxes from the wall. Assuming these bounds will not be exceeded in future devices, it is then possible to estimate permissible impurity concentrations from stationary solutions of the ionization-recombination balance and impurity transport equations. In the interior of the plasma, the concentration should be small enough that the radiative power density remains at a fraction of the deposited α-particle power. Enhanced recombination, e.g., by charge transfer with injected neutrals, may lead to more stringent conditions for plasma purity.

58848 (EUR—6584(Vol.1), pp 455-457) **Computer models for fusion plasmas.** Duechs, D. (EURATOM-IPP Association, Garching, Germany, F.R.). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

58849 (EUR—6584(Vol.1), pp 459-473) **Mathematical and technical problems involved in codes for plasmas in toroidal devices.** Taroni, A. (CNEN, Bologna (Italy)). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This lecture presents a survey of mathematical and technical problems connected with the development of codes for the study of plasmas confined in toroidal devices. Some currently used numerical methods are explained; difficulties and limitations due to the finite capability of the available computers are pointed out.

58850 **(EUR—6584-Vol.1) Physics of plasmas close to thermonuclear conditions: proceedings.** Coppi, B.; Leotta, G.G.; Pfirsch, D.; Pozzoli, R.; Sindoni, E. (eds.). (Commission of the European Communities, Brussels (Belgium)). 1979. 489p. (CONF-790866—Vol.1). NTIS (US Sales Only), PC A21/MF A01. Order Number DE82780712.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Separate abstracts for each paper were entered into the data base. (MOW)

58851 (EUR—6584(Vol.2), pp 479-499) **Plasma thermal energy transport: theory and experiments.** Coppi, B. (Massachusetts Institute of Technology, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Experiments on the transport across the magnetic field of electron thermal energy are reviewed (Alcator, Frascati Torus). In order to explain the experimental results, a transport model is described that reconfirmed the need to have an expression for the local diffusion coefficient with a negative exponent of the electron temperature.

58852 (EUR—6584(Vol.2), pp 571-586) **Fast wave heating in the Princeton Large Torus.** Hosea, J.; Arunasalam, V.; Bernabei, S. (Princeton University, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Fast wave heating in the ion cyclotron range of frequencies (ICRF) is being studied on the Princeton Large Torus (PLT) to evaluate its potential for heating large reactor-scale toroidal plasmas. Of primary interest are the two-ion and pure second harmonic heating regimes which, with proper control of the ion energy distribution and the rf power deposition profile, permit substantial energy flow into the bulk plasma ions. Initial heating experiments have been conducted with a single 1/2 turn antenna up to wave powers of P(rf) approximately= 350 kW for durations of > or approximately 100 ms in the two-ion regime under conditions for which direct fundamental cyclotron damping on the minority ion species dominates the wave absorption. Ion-ion coupling serves to heat the majority ions and for energetic minority ion energy distributions, energy flow to the electrons results from electron drag. Substantial ion heating is found for D-p mixtures; $\Delta T(d)(0)$ approximately 600 eV for 350 kW with nsub(e) approximately 2 x 10^{13} cm^{-3}. The deuteron heating efficiency is improved by about a factor of approximately 2 in $D^{-3}He$ mixtures; $\Delta T(d)(0)$ approximately 500 eV for 150kW with nsub(e) approximately 2.1 x 10^{13} cm^{-3}.

58853 (EUR—6584(Vol.2), pp 587-615) **Experimental results from present-day high field tokamaks.** Pieroni, L. (Associazione EURATOM-CNEN sulla Fusione, Centro di Frascati, Italy). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The aims and scientific motivations of high magnetic field Tokamaks at the begining of the world-wide effort on toroidal diffused pinches are recalled. They are compared with the experimental results obtained in actual machines like ALCATOR-A at MIT and FT at CNEN in Frascati. The importance of these results with regard to the goal of nuclear fusion is emphasized, especially considering the high density regimes achieved and the phenomenological scaling laws derived from them.

58854 (EUR—6584(Vol.2), pp 617-632) **Preliminary results of noncircular plasma experiments in Doublet III.** Ohkawa, T. (General Atomic Company, San Diego, CA, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Preliminary results of noncircular plasma experiments in Doublet III are reported. Shaping and discharge characteristics in doublet plasma with high-Z limiters are described. Electron energy confinement and maximum plasma density are in agreement with standard circular tokamak empirical scaling laws. Chromium and molybdenum appear to be the dominant high-Z contaminants while carbon appears to dominate low-Z contaminants. High-Z impurity radiation does not appear to dominate the central power balance.

58855 (EUR—6584(Vol.2), pp 659-677) **Magnetic mirror confinement of high-energy, high-density plasma.** Coensgen, F.H.; Simonen, T.C. (University of California, Livermore, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

This paper summarizes results obtained from and work in progress on those experiments which have contributed significantly toward the confinement in single-cell magnetic mirror systems of plasmas close to thermonuclear conditions. Because the mirror confinement of such high-energy, high-density plasmas has been studied most extensively in the 2XIIB experiment, discussion of 2XIIB results forms a major portion of this paper. In these experiments, injection of low-energy plasma has been shown to suppress microinstabilities to sufficiently low levels that high-beta (β approximately 1) plasmas could be achieved and sustained by cross-field injection of beams of neutral particles. Plasma confinement was found to improve with ion energy, electron temperature, and plasma size. Based on these results, a large Mirror Fusion Test Facility (MFTF) was designed to pursue confinement scaling to higher energies and larger plasma dimensions. MFTF design parameters and construction status are briefly reviewed.

58856 (EUR—6584(Vol.2), pp 749-775) **Steps toward increasing Q in mirror systems.** Post, R.F. (University of California, Livermore, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Experiments such as the 2XIIB experiment at Livermore have established the ability of mirror systems to confine high temperature, high density plasmas at central beta values exceeding unity. Given these results the next tasks for the mirror aproach are to explore means for increasing the energy gain factor Q and to scale up the plasma volume, both of these requirements deriving from economic constraints. This report will discuss means for incresing Q, including recent improvements in the tandem mirror concept and design studies of the field-reversed mirror in the context of upcoming and proposed scaled-up mirror experiments.

58857 **(EUR—6584-Vol.2) Physics of plasmas close to thermonuclear conditions: proceedings.** Coppi, B.; Leotta, G.G.; Pfirsch, D.; Pozzoli, R.; Sindoni, E. (eds.). (Commission of the European Communities, Brussels (Belgium)). 1979. 404p. (CONF-790866—Vol.2). NTIS (US Sales Only), PC A18/MF A01. Order Number DE82780713.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Separate abstracts for each paper were entered into the data base. (MOW)

58858 **(EUR-CEA-FC—1083) Comments on ideal ballooning.** Dagazian, R.Y.; Paris, R.B. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee). Sep 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701974.

Ideal ballooning modes are investigated for the case of plane magnetized slab geometry.Toroidal effects are simulated by a gravitational acceleration periodically varying along magnetic field lines. High shear is shown to be very effective in stabilizing these modes even when field line curvature is most unfavorable to their stability.

58859 **(EUR-CEA-FC—1117) Parametric instabilities in an electron beam-plasma system: magnetic field effects.** Gell, Y.; Levush, B.; Nakach, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee). Sep 1981. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701976.

The effects of a magnetic field on the excitation of low-frequency parametric instabilities in a beam-plasma system are considered. The dispersion relation of the three-dimensional beamless configuration, is analytically evaluated for an electrostatic pump wave having a finite wave-vector parallel to the magnetic field. The results of this analysis serve as a guide to the numerical study of the stability of the involved system including the beam. As for the one-dimensional case, one finds that two low-frequency electrostatic instability branches having different growth rates may exist simultaneously. The effects of the magnetic field on these instabilities could be summarized as follows: the small growth rate instability is negligibly small when the electron gyrofrequency is about equal to the pump wave frequency. This instability is magnetic field independent for high enough values of the field. When the plasma electron Debye length is greater than the beam electron Debye length, a large growth rate instability is excited and appears to be weakly dependent on the magnetic field, while the two instability branches are quite sensitive to change of the magnetic field, when the two Debye lengths are equal. Other characteristics of this system are also discussed.

58860 **(EUR-CEA-FC—1125) Asymptotic behavior of certain solutions of Benard convection two-dimensional problems.** Saramito, B. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee). Sep 1981. 24p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701977.

In connection with a digital study of convective movements in a cylindrical layer of plasma, it became necessary to explicit certain results relating to the bi-dimensional problem of Rayleigh-Benard convection. For the coupled system of Navier-Stokes equations and the heat transport equation, consideration is given to "free" type boundary conditions for the velocity on both horizontal planes which limit the plane layer of fluid studied. Asymptotic increases (for very great times) of the single solution of this problem are then obtained, using a formulation by means of velocity current function. These increases then enable a study to be made analogous to that which C. Foias and G. Prodi (1967) made for the Navier-Stokes equation with "rigid" type boundary conditions for the velocity (V vector= 0 on the edge): a sufficient condition is then obtained for the asymptotic behaviour of certain classes of solutions of the problem to be correctly described by that of the projection of these solutions over a finite dimension space. This conditions is expressed as a criterion linking the dimension of this space to the Rayleigh R number, with an almost linear dependence in R.

58861 **(EUR-CEA-FC—1127) Slowing-down of fast ions in a Tokamak plasma. 1. Theoretical part.** Mercier, C.; Capes, H.; Morera, J.P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee). Oct 1981. 61p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82701978.

In the first part of this work, the equation of the change in the distribution function of fast particles, averaged out on the angular variable theta was explicited. It was shown that the resolution of this equation involves the prior determination of ten coefficients which depend on the invariants of the collision-free movement. In a second part, a study was made of the transformation of variables which makes it possible to pass from the usual variables of space and velocity (r, theta, P, v) to the variables defined by the invariants of the collision-free movement. In this new space the domain of resolution of the previous equation was determined as were also the associated boundary conditions. A very simple method is also given whereby, knowing the three invariants ν, lambda, v and additional variable sigma, the nature of the path and its characteristic points may be completely determined. With this information, it becomes possible to associate, at each point of the domain (ν, lambda, v, sigma) a value for each of the ten coefficients and then the determination of the distribution function of the fast particles can be undertaken.

58862 **(EUR-CEA-FC—1132) Variational equations of hydromagnetic equilibria.** Bineau, M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee). Oct 1981. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701979.

The structure of the variational equations of hydromagnetic equilibria is analyzed in this article. Some smooth equilibrium epsilon is assumed to be given. For reasons related to the method of approach epsilon has a tubular form (without magnetic axis) and its magnetic field is nearly a vacuum magnetic field. The variation is taken in a class of equilibria containing epsilon. This class is further defined by boundary conditions (in a broad sense). We seek solutions in a Hilbert space of functions with generalized derivatives. The solutions depend on the data of two functions of one variable (they represent physically the variations of the pressure and of the longitudinal current inside a flux surface). A uniqueness theorem is obtained for these data. It is completed by an existence theorem in case of axisymmetry and by a conditional non existence theorem otherwise.

58863 (FUPH-R—180) **Low power, long duration Rotamak discharges in argon.** Jessup, B.L.; Tendys, J. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Feb 1982. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701980.

An investigation is made of a Rotamak compact torus configuration in which the rotating magnetic field used to drive the toroidal current is generated by a pulsed 6 KW R.F. oscillator. The toroidal current is measured together with the vertical component of the magnetic field both along the vertical axis and as a function of radius in the midplane of the current ring. The experimental results show that a Rotamak equilibrium, apparently stable for several milliseconds, could be obtained. Toroidal plasma currents of several hundred amps were observed with argon filling pressures around 0.2 mTorr and applied vertical equilibrium fields of about 1 m Tesla.

58864 (ILE—8011P) **Modified Thomson parabola ion spectrometer of wide dynamic range.** Sakabe, S.; Mochizuki, T.; Yamanaka, T.; Yamanaka, C. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 14 Jul 1980. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702505.

A modified Thomson parabola ion spectrometer of a wide dynamic range for studies of flash ion emitted from laser produced plasmas was developed. The exact velocity distributions of different ion species were obtained separately with sufficient velocity resolution.

58865 (INIS-mf—7064) **Wills Plasma Physics Department annual progress report 1981.** (Sydney Univ. (Australia). School of Physics). 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701981.

Progess is reported on research programs which are proceeding in the following areas: comissioning of the TORTUS research tokamak, plasma diagnostics, non-linear hydromagnetic waves and shock waves, and laser and gyrotron diagnostics.

58866 (IPPJ—505) **Study of effects of impurity ions and neutral atoms on reversed-field pinch by 2-D MHD pinch simulation.** Nagata, A.; Ashida, H.; Okamoto, M.; Hirano, Y.; Maejima, Y. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701984.

Two-dimensional MHD pinch simulation code, "TOPICS", which includes the effects of the impurity ions, the neutral atoms and anomalous resistivity, has been applied to the investigation of the RFP-plasmas at the setting-up phase of the TPE-lR. Simulations are compared with the typical two cases of the experiment: (a) the lower initial bias field and the higher plasma current density and (b) the higher initial bias field and the lower plasma current density. The magnetic field profiles at the setting-up phase in the experiments can be fairly well explained by the simulation assuming the 50% ionization degree of the initial plasma and the presence of 10% oxygen. It is also found from the simulation that the radiation loss due to 5 to 10% impurities is the dominant electron energy loss mechanism. The toroidal magnetic field profile at the setting-up phase calculated by using the isotropic anomalous resistivity is much narrower than that by the classical resistivity.

58867 (IPPJ—510) **Model equations for nonlinear time evolution of the dissipative trapped ion instability.** Hatayama, A.; Koshi, Y.; Ogasawara, M. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701986.

A set of model equations of the dissipative trapped ion instability is derived to confirm Saison, Wimmel and Sardei's infer that modification of the background trapped particle number density may be a possible saturation mechanism. Multiple time scale expansion scheme is applied to the nonlinear fluid equations of Kadomtsev and Pogutse by employing a usual ordering νsub(i) $<< \omega <<$ νsub(e), where νsub(j) is the effective collision frequency of j-th trapped particles and ω is the frequency of the instability. Model equations derived describe the time evolution of the modification of the background trapped particle number density and the amplitude of the dissipative trapped ion mode.

58868 (IPPJ—516) **Oscillation of the trapped flux in the early phase of a reversed field theta-pinch.** Wu, Ch.; Aso, Y.; Himeno, S.; Yamaguchi, S.; Hirano, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Apr 1981. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701987.

Magnetic probe measurements show that the flux trapped into the neutral sheet radius R sub(o) at the early phase of the reversed field theta-pinch does not decrease monotonously but oscillates. We proposed a model that the oscillation may be caused by the off-diagonal element of the ion pressure tensor P sub(r theta)sup(i) which may also drive the plasma rotation. The accuracy of probe measurement was confirmed to be less than 10% by using the excluded flux. The experimental data are compared with the results of one dimensional hybrid code. We found the agreement between the two is fairly good.

58869 (IPPJ—517) **Amount of impurity and its behavior in the STP-2 screw pinch tokamak.** Yamaguchi, S. (Nagoya Univ. (Japan). Inst. of Plasma Physics). May 1981. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701988.

Temporal and spatial evolution of oxygen spectral line intensities have been measured in the STP-2 screw pinch tokamak. The electron density and temperature as measured by Thomson scattering are of the order of 10^{14} cm^{-3} and 10 eV, respectively. On the basis of these measurements, quasi-steady-state rate equations have been solved to give the OII and OIII ion densities. It is found that the density of oxygen impurity is about several percent of the electron density, and the impurity moves with the bulk plasma. It is confirmed that the impurity originates from the wall of the discharge tube during the initial phase of the discharge.

58870 (IPPJ—521) **Conducting liquid conveyer of plasma rings.** Tomita, Y.; Mohri, A. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701989.

Current-carrying plasma rings can be conveyed in a cylindrical channel with a conducting liquid flow to which outer poloidal fields of the rings freeze. Fast tilting motion of the ring is stabilized when the liquid surface is set close to the ring within a critical distance. Effects of a resistive tube duct installed for the liquid are also examined.

58871 (IPPJ—522) **Plasma confinement in ECH bumpy torus.** Fujiwara, M.; Hosokawa, M.; Iguchi, H.; Ikegami, H.; Kamimura, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1981. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701990.

Theoretical and experimental researches are reviewed on plasma confinement in ECH bumpy torus. Numerical study on particle confinement found that the particle confinement by vaccum magnetic field is the combination of toroidal and mirror-like trap depending strongly on spatial position. The ambipolar potential improves confinement greatly and the critical energy of confined particles W is up to epsilon sub(t)sup(-1)(e phi) (here epsilon sub(t) and phi are the inverse aspect ratio and plasma potential well or hill), while W -- e phi in tandem mirror configuration. Some useful suggestions are given to conventional neoclassical transport theory. Experimental results are also surveyed, especially focused on the scaling laws of the toroidal core plasma and hot electron ring parameters. The formation of hot electron rings is possible under some special conditions where ECH heating overcome the Coulomb drag cooling by background plasmas. In other words this condition determines the maximum density of toroidal core plasma. Attainable beta value or stored energy of hot electron rings is summarized by using experimental data of various machines. Brief report is presented on recent experiments of ICH in NBT device. ICH not only contributes to ion heating, but affects the plasma potential which has an important effect on transport. Some results are also reported with respect to theoretical analysis of stability and equilibrium.

58872 (IPPJ—523) Edge cooling of hot plasma with the help of radio frequency wave. Ikuta, K.; Hatori, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1981. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701991.

An effect of the RF potential to the trapped particles in tokamaks is considered in detail. And the behavior of impurity derived from the RF potential can be applicable to the edge cooling of hot plasma using the radiation loss from the concentrated impurities in the plasma periphery.

58873 (IPPJ—536) Electromagnetic cyclotron harmonic waves. Ohnuma, T.; Watanabe, T.; Hamamatsu, K. (Nagoya Univ. (Japan)). Sep 1981. 15p. NTIS, PC A02/MF A01.

Electromagnetic electron cyclotron harmonic waves just below the electron cyclotron harmonics were investigated numerically and experimentally. Backward waves which were observed to propagate nearly perpendicular to the magnetic field just below the electron cyclotron frequency in a high density magnetoplasma were confirmed to be in accord with the theoretical electromagnetic cyclotron waves.

58874 (IPPJ—543) Numerical study on the interaction between a modulated electron beam and a plasma. Fukumasa, O.; Itatani, R. (Nagoya Univ. (Japan)). Sep 1981. 48p. NTIS, PC A03/MF A01.

Interaction of a modulated electron beam with a plasma is calculated for unbounded and bounded electron beam-plasma systems, using the method of partial simulation. In the case of the unbounded system, deformation of the beam distribution function is occurred in relation to suppression of one wave by the other wave. While, in the case of the bounded system, occurrence of deformation depends on whether feedback effects of reflected beams are present or not. The findings are qualitatively in agreement with experimental results.

58875 (IPPJ—544) Oxygen transport and line emissions in a tokamak plasma. Kato, T.; Kako, M.; Amano, T.; Nomura, Y.; Hayakawa, S. (Nagoya Univ. (Japan)). Sep 1981. 34p. NTIS, PC A03/MF A01.

Two models which describe the behavior of impurity in tokamaks are investigated: one is the drift model and the other the diffusion model. The drift model is a simplified one in which impurity ions drift only inward, while the diffusion of impurities is taken into account in the diffusion model. The results of the two models are compared. Spectroscopic data on oxygen impurities in JIPP T-2 tokamaks are employed for comparison with the theoretical results in which metastable populations were considered to calculate the line intensities. Oxygen transport is well interpreted with the neutral influx of energy 10 to 50 eV and anomalous diffusion of magnetic 5000 (n sub max/n sub e(r)) sq cm/sec.

58876 (IPPJ—545) Toroidal plasma current sustainment by lower hybrid waves in the WT-2 tokamak. Nakamura, M.; Cho, T.; Kubo, S.; Shimozuma, T.; Kawai, H.; Yamazaki, Y.; Maekawa, T.; Terumichi, Y.; Tanaka, S.; Hamada, Y. (Nagoya Univ. (Japan); Kyoto Univ. (Japan)). Oct 1981. 16p. NTIS, PC A02/MF A01.

Injecting RF power P sub RF near the lower hybrid frequency into an Ohmic heating plasma near the end of Tokamak discharge in the WT-2, and RF driven current sustained plasma is produced and continued to exist during the rf injection period, where the toroidal current (T sub p approximately 10 kA) is generated by the lower hybrid wave only without the Ohmic power. The efficiency of RF driven current generation is high and attains to I sub/P sub RF approximately 0.9 kA/kW.

58877 (IPPJ—546) Energy and momentum deposition to plasmas due to the lower hybrid wave by a finite source. Nakajima, N.; Abe, H.; Itatani, R. (Nagoya Univ. (Japan)). Oct 1981. 68p. NTIS, PC A04/MF A01.

Heating and current generation due to the lower hybrid wave are studied using particle simulation. A propagation cone consisting of Fourier expanded modes is emphasized. The trajectory of the propagation cone is well described up to the lower hybrid resonance layer using both cold plasma approximation and the Wentzel-Kramer-Brillouin method. An ion cross field drift due to the ponderomotive force is observed. The modes in the higher side of the spectrum of the antenna play a key role for creation of the ion high energy tail. This process is called the cascade process judging from the time variation of the damping of each mode. The particle model is significantly improved using the elongated grid and the quadric spatial interpolation.

58878 (IPPJ—547) Soft and hard major disruptions in the profile control experiment of the JIPP T-2 tokamak. Toi, K.; Sakurai, K.; Tanahashi, S.; Yasue, S. (Nagoya Univ. (Japan)). Sep 1981. 43p. NTIS, PC A03/MF A01.

The nonlinear saturation theory of tearing modes is applied to the tokamak plasmas produced by an appropriate combination of gas puffing and plasma current-rise in JIPP T-2. The calculated relative amplitude of poloidal field fluctuations has good correlation with the experimental data. The radial extent of the island widths of m/n 2/1 and 3/2 modes which are derived in the calculation suggests that the soft major disruption, where a plasma current suffers only slight change, can be triggered by either the overlapping of 2/1 island with 3/2 one or the contact of 2/1 island with a limiter. Moreover, it is consistent with the experimental data the hard major disruption, which brings about the abrupt and significant reduction of the plasma curent, results from the combined process of two above-mentioned causes of the soft major disruption.

58879 (IPPJ-DT—79) Plasma heating. Various methods of supplementary heating. Sugihara, R.; Kaneko, O. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1981. 48p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701994.

Plasma heating is one of the important problems of fusion reactor technology. It is known that ohmic heating is not sufficient to satisfy the Lawson condition. This paper reviews the supplementary heating methods for plasma. Neutral beam injection is one of the methods of supplementary heating. The neutral beam with high energy is ionized, confined and thermalized in plasma. The power balance of ions and that of electrons determine plasma temperature. The impurity ions in plasma are the cause of radiation loss. The experiment at PLT achieved successfully neutral beam injection heating, and the temperature of 5.5 keV was obtained. The radio frequency wave (RF) heating is another method. The ion cyclotron range of frequency (ICRF) heating, the lower hybrid resonance (LHR) heating, and the electron cyclotron resonance heating are the typical RF heating. The instruments for these heating methods are easily available, and the energy transmission into plasma core is easy. As other methods, the adiabatic compression heating is also described.

58880 (JAERI-M—9456) Electrostatic ballooning mode. Tuda, T.; Itoh, K.; Tokuda, S.; Itoh, S.I. (Japan Atomic Energy Research Inst., Tokyo). Apr 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701998.

Numerical solution of high-n electrostatic ballooning mode is obtained without approximations. We keep correct forms of electron and ion responses to the wave. We find instabilities which arise due to toroidal effects. The dependences on the aspect ratio, magnetic shear, and wave length are also studied. The growth rate γ is large and satisfies the relation $\omega < \gamma$ -- ω sub(*). Depending on the parameters the real frequency ω changes its sign. The drift mode, which has been found stable in a slab plasma, persists in the toroidal plasma remaining almost always stable. The density fluctuations in tokamaks, which have been observed by use of the microwave scattering method, can be qualitatively explained by the theory of the electrostatic ballooning mode.

58881 **(JAERI-M—9589) High density low-q discharges with D-shaped plasmas in Doublet III.** Nagami, M.; Yoshida, H.; Shinya, K.; Yokomizo, H.; Shimada, M.; Ioki, K.; Izumi, S.; Kitsunezaki, M.; Jahns, G. (Japan Atomic Energy Research Inst., Tokyo). Jul 1981. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702003.

The maximum plasma current in Doublet III is found to be limited by disruptions when the limiter safety factor is approximately 2. However, due to the strong toroidal and shaping field effect on rotational transform at the outer plasma edge associated with a D-shape formation having a vertical elongation of 1.5, the safety factor q sub(a) * estimated from simple geometric considerations for D-shaped plasmas corresponds to values as low as 1.5. These discharges operate stably with considerably higher plasma current than most reactor design studies assume. These low-q discharges show excellent plasma performance: very flat spatial electron temperature progiles, high density operation with anti n sub(e)R/B sub(T) up to 7.8, and good energy confinement producing a volume average β of up to 1% with ohmic heating only. This operational regime appears to be applicable to future high β tokamaks with D-shaped cross section.

58882 **(KFTI—81-35) Dynamics of high turbulence of highly-hydrid waves in inhomogeneous electric field.** Brazhnik, V.A.; Grishaev, V.I.; Demchenko, V.V.; Omel'chenko, A.Ya.; Pavlov, S.S.; Panchenko, V.I. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702004.

Turbulization of homogeneous magneta active plasma under the effect of an inhomogeneous alternating electric field is studied in the hydrodynamic approximation. The process of parametric excitation of highly-hybrid waves in the weak and strong-coupling wave modes is analytically studied. It is shown that pumping wave inhomogeneity favours localization of plasma waves resulting in the absolute character of parametric instability developed in plasma. Numerical simulation permitted to find out that saturation of absolute parametric instabilities has a strong turbulent nature, the basis of which is generation of high-hybrid solitons by the ponderomotive force effecting plasma and caused by the electric field of instable waves. The relaxation character of soliton generation is explained as following: in the course of time solitons interact with each other in a complex way that leads to increasing the multiplicity of soliton formations.

58883 **(KFTI—81-36) Kinetics of neutral atoms in thermonuclear devices.** Besedin, N.T.; Marushchenko, N.B.; Pyatov, V.N. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702005.

A system of integral equations for the density of neutral atoms and their energy is numerically solved. The Maxwell and monoenergetic plasma ion distributions are calculated with regard to diffusive and ideal atom reflection from the wall, using the experimentally obtained ionization cross sections, charge exchange, recombination and the reflection coefficient. It follows from the calculations that in contrast to the neutral atom energy their density distribution weakly depends on the type of the ion distribution function. Using the measured plasma density and temperature distributions, the peculiarities of the neutral atom behaviour in discharge can be revealed. The solutions obtained for the basic equations permitted to determine the neutral atom flux on the wall, the carried out of the discharge energy, as well as using the experimentally measured coefficients of material sputtering, the amount of impurities appeared as a result of sputtering by atoms can be calculated.

58884 **(KFTI—81-43) Integral methods of plasma equilibrium calculation in TOKAMAK.** Kilovataya, T.G.; Pyatov, V.N. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702511.

The method of numerical simulation on the basis of integral equations of quasistationary axial-symmetric plasma with a current of an arbitrary cross section is considered in the MHD approximation. The effect of different perturbation factors (ferromagnetic screens, external stationary currents) on parameters of the magnetic configuration is taken into account. The mathematical algorithms permitting to take into account optimizations while choosing the system of control of plasma filament location are constructed.

58885 **(LA-UR—82-2147) Compact toroidal plasmas: simulations and theory.** Harned, D.S. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 9p. (CONF-820930—4). NTIS, PC A02/MF A01. Order Number DE82018107.

From 9. international conference on plasma physics and controlled nulcear fusion research; Baltimore, MD, USA (1 Sep 1982).

Realistic FRC equilibria are calculated and their stability to the n = 1 tilting mode is studied. Excluding kinetic effects, configurations ranging from elliptical to racetrack are unstable. Particle simulations of FRCs show that particle loss on open field lines can cause sufficient plasma rotation to drive the n = 2 rotational instability. The allowed frequencies of the shear Alfven wave are calculated for use in heating of spheromaks. An expanded spheromak is introduced and its stability properties are studied. Transport calculations of CTs are described. A power balance model shows that many features of gun generated CT plasmas can be explained by the dominance of impurity radiation. It is shown how the Taylor relaxation theory, applied to gun generated CT plasmas, leads to the possibility of steady state current drive. Lastly, applications of accelerated CTs are considered.

58886 **(LA-UR—82-2262) Simulation of plasma double-layer structures.** Borovsky, J.E.; Joyce, G. (Los Alamos National Lab., NM (USA); Naval Research Lab., Washington, DC (USA)). 1982. Contract W-7405-ENG-36. 7p. (CONF-8205113—1). NTIS, PC A02/MF A01. Order Number DE82019536.

From Symposium on plasma double layers; Roskilde, Denmark (1 May 1982).

Electrostatic plasma double layers are numerically simulated by means of a magnetized 2 1/2-dimensional particle-in-cell method. The investigation of planar double layers indicates that these one-dimensional potential structures are susceptible to periodic disruption by instabilities in the low-potential plasmas. Only a slight increase in the double-layer thickness with an increase in its obliqueness to the magnetic field is observed. Weak magnetization results in the double-layer electric-field alignment of accelerated particles and strong magnetization results in their magnetic-field alignment. The numerial simulations of spatially periodic two-dimensional double layers also exhibit cyclical instability. A morphological invariance in two-dimensional double layers with respect to the degree of magnetization implies that the potential structures scale with Debye lengths rather than with gyroradii. Electron-beam excited electrostatic electron-cyclotron waves and (ion-beam driven) solitary waves are present in the plasmas adjacent to the double layers.

58887 **(LRP—176/80) Ideal MHD stability of oblate spheromaks and β optimization.** Gautier, P.; Gruber, R.; Troyon, F. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland); SEE CODE- 9100585 Ecole Normale Superieure, 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Dec 1980. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82903472.

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An oblate spheromak surrounded by a conducting shell can stably confine a plasma with non-vanishing pressure. Using the ERATO code we find that whenever q/sub axis reversible 1 an internal kink develops, while for q/sub axis/ < 1 the Mercier criterion limits the β value. This leads to a β limit which inceases with the aspect ratio. For an aspect ratio of 2.4, equilibria with β reversible 40% have been found which are stable to both low-n and high-n modes. Withut a shell these equilibria are unstable; the fastest growing mode being a n = 1 tilting motion. A shell at a distance of the order of 0.2 to 0.4 the minor plasma radius stabilizes the low-n modes.

58888 (PPPL—1899) Identification of magnetic dipole lines above 2000 A in several Mo and Zr ions on the PLT tokamak. Suckewer, S.; Hinnov, E.; Cohen, S.; Finkenthal, M.; Sato, K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1982. Contract AC02-76CH03073. 12p. NTIS, PC A02/MF A01. Order Number DE82014865.

A number of spectrum lines arising from magnetic dipole transitions in the n = 3 shell ground configurations of molybdenum and zirconium ions have been identified. These lines are particularly suitable for spectroscopic diagnostics in tokamak-type plasmas in the 500 to 1500 eV temperature range.

58889 (PPPL—1915) Plasma transport in stochastic magnetic fields. III. Kinetics of test-particle diffusion. Krommes, J.A.; Oberman, C.; Kleva, R.G. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1982. Contract AC02-76CH03073. 67p. NTIS, PC A04/MF A01. Order Number DE82020259.

A discussion is given of test particle transport in the presence of specified stochastic magnetic fields, with particular emphasis on the collisional limit. Certain paradoxes and inconsistencies in the literature regarding the form of the scaling laws are resolved by carefully distinguishing a number of physically distinct correlation lengths, and thus by identifying several collisional subregimes. The common procedure of averaging the conventional fluid equations over the statistics of a random field is shown to fail in some important cases because of breakdown of the Chapman-Enskog ordering in the presence of a stochastic field component with short autocorrelation length. A modified perturbation theory is introduced which leads to a Kubo-like formula valid in all collisionality regimes. The direct-interaction approximation is shown to fail in the interesting limit in which the orbit exponentiation length L/sub K/ appears explicitly. A higher order renormalized kinetic theory in which L/sub K/ appears naturally is discussed and used to rederive more systematically the results of the heuristic scaling arguments.

58890 (Rijnhuizen—81-134) Equilibrium studies of skin-like pressure and current-density profiles. Kolfschoten, A.W. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Sep 1981. 52p. NTIS (US Sales Only), PC A04/MF A01.

During the last few years considerable attention has been devoted to the study of turbulent heating as a heating method for large plasma volumes. In TORTUR - and other related experiments - the application of a heating pulse leads to anomalous heating without macroscopic plasma deformation. Immediately after the heating pulse is applied, the discharge is usually characterized by hollow pressure and current profiles that at the end of the pulse have filled up and have evolved into normal tokamak-like parabolic profiles. Since the plasma properties are such that, even on the μs timescale, MHD equilibrium can be established, we investigated the properties of a class of MHD equilibria that give rise to such characteristic pressure and current profiles. For this investigation a computer code for toroidal ideal MHD equilibria was rewritten and improved. The improvement of the code consists in employing a Moebius transformation, which maps the plane of the cross-section onto a plane in which the magnetic axis coincides with the origin of the coordinate system. This results in a code that can easily handle concave pressure and current profiles. The profiles obtained by means of this code show good agreement with the experimentally measured ones. The use of the mapping has resulted in a code with an improvement of convergence for high-beta cases.

58891 (Rijnhuizen—81-135) Influence of impurities on the discharge behaviour in SPICA. van der Meer, A.F.G. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Oct 1981. 67p. NTIS (US Sales Only), PC A04/MF A01.

Discharges in the screw pinch SPICA can be produced in a small range of filling pressures and bias field values. The experimentally observed lower limit of 6 mtorr for the filling pressure is explained by the onset of MHD instabilities and by imperfect implosion at low values of the filling pressure at high values of the bias field. In the accessible parameter regime, discharges can be produced with densities of the order of 5×10^{21} m^{-3} and temperatures between 30 and 80 eV, which show gross stability for 200 μs, albeit not reproducible. In this density and temperature range discharges can easily become dominated by energy losses due to impurity radiation. An investigation of the temperature decay and the impurity concentration shows that, in spite of the quartz liner, this is not the case under normal operating conditions and that the energy containment time is of the order of 200 μs. The temperature decay rate, measured by means of Thomson scattering, is only 0.15 eV/μs, whereas from the intensity ratio of the 15.0 nm 2s ^2S - 3p $^2p^0$ and the 103.2 nm 2s ^2S - 2p $^2P^0$ OVI emission lines a decay rate of 0.3 eV/μs is derived. From absolute intensity measurements an oxygen concentration is derived. Besides oxygen, also silicon and nitrogen are present in the discharge. The nitrogen concentration that follows from absolute intensity measurements is in fair agreement with estimates based on an analysis of the background gas. The silicon concentration has not been measured directly, but it is estimated to be less than half the oxygen concentration since the wall material is quartz (SiO_2) and part of the oxygen originates from the background gas, mainly as a constituent of water vapour.

58892 (Rijnhuizen—81-136) Time-of-flight analysis of charge-exchange neutral particles from the TORTUR II plasma. Brocken, H.J.B.M. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Oct 1981. 22p. NTIS (US Sales Only), PC A02/MF A01.

A disc chopper for time-of-flight analysis of fast neutral particles was constructed for the determination of the ion energy spectrum at lower energies than can be obtained by conventional electro-magnetic analyzers. The method has been applied to the TORTUR II tokamak. The chopper and detection system are described and the measurements are presented. For the interpretation of the results of the measurements a data analysis procedure was developed. The influence of reflections of neutrals at the liner wall showed to be important in the calculations of the neutral density profile at the plasma edge. The neutral energy spectrum in the lower energy range is strongly pronounced by this effect.

58893 (Rijnhuizen—81-137) Space- and time-resolved measurements of ion energy distributions by neutral beam injection in TORTUR II. Brocken, H.J.B.M. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Oct 1981. 35p. NTIS (US Sales Only), PC A03/MF A01.

A method is described for the space- and time-resolved analysis of ion energy distributions in a plasma. A well-collimated neutral hydrogen beam is used to enhance the charge-exchange processes. The method is used in the TORTUR II tokamak to study the space and time evolution of the ion temperature profile of the plasma. The analytical background and the technique are described in detail. Examples of measurements on TORTUR II are presented.

58894 (STUDSVIK—81/2) Magnetic compression, non-adiabatic particle motion and intrinsic stochasticity. Persson, H. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 23 Sep 1981. 13p. (CONF-810906—13). NTIS (US Sales Only), PC A02/MF A01.

From 10. European conference on controlled fusion and plasma physics; Moscow, USSR (14 Sep 1981).

Results from an ongoing study of magnetic compression of plasma and non-adiabatic particle motion are reported. A quasistationary model is adopted, with magnetically interacting, cylindrical sheets of particles, the motion of which and their mutual inductive coupling with the electromagnetic field are analysed. Phenomena like a discontinuous dependence of several quantities on canonical angular momentum around the value zero, and a magnetic energy inversion are found, as well as a transition from an integrable or near-integrable system for small value of the shielding capacity to stochastic behaviour for greater values of the latter. A particular two-sheet system exhibits apparently irregularly occurring transitions between an asymmetric mode with different oscillator frequencies and a symmetric one with frequency locking and strong interchange of energy and action, leading to a sawteeth variation of the latter. During the symmetric mode, nearby orbits in phase space diverge exponentially, with a KS-entropy corresponding to 1/8 of the gyro frequency in the external magnetic field.

58895 **(TRITA-PFU—81-05) Confinement and related transport in Extrap geometry.** Tendler, M. (Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics and Fusion Research). Dec 1980. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702008.

The properties of the plasma equilibrium are investigated for the Extrap magnetic confinement geometry. An analytical solution for the profiles of the plasma parameters are found under the assumption that the energy is lost primarily in the radical direction by heat conduction and convection. An estimate of the radial particle confinement time is given, showing favorable scaling with plasma density and temperature. The conventional assumption of a uniform current density is shown to be unjustified in the case of an inhomogeneus electron temperature. An analytical expression is found for the pinch radius at different mechanisms of the heat transport.

58896 **(TRITA-PFU—82-01) Plasma balance equations based on orbit theory.** Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Jan 1982. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702513.

A set of plasma balance equations is proposed which is based on orbit theory and the particle distribution function, to provide means for theoretical analysis of a number of finite Larmor radius (FLR) phenomena without use of the Vlasov equation. Several important FLR effects originate from the inhomogeneity of an electric field in the plasma. The exact solution of a simple case shows that this inhomogeneity introduces fundamental changes in the physics of the particle motion. Thus, the periodic Larmor motion (gyration) is shifted in frequency and becomes elliptically polarized. Further, the non-periodic guiding-centre drift obtains additional components, part of which are accelerated such as to make the drift orbits intersect the equipotential surfaces of a static electric field. An attempt is finally made to classify the FLR effects, also with the purpose of identifying phenomena which have so far not been investigated.

58897 **(TRITA-PFU—82-03) Equilibrium and stability of a toroidal-sector plasma discharge in an EXTRAP configuration.** Drake, J.R. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Feb 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702515.

Experimental studies of the equilibrium and stability of a sector of a toroidal EXTRAP plasma discharge have been studied. The high β plasma discharge, which had an Alfven transit time about 0.5 μsec, could be positioned in a stable equilibrium for the 300μsec time scale of the experiment.

58898 **(TRITA-PFU—82-04) Discharge breakdown in the EXTRAP configuration.** Drake, J.R. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Feb 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702498.

The breakdown of a discharge in a linear EXTRAP configuration has been studied experimentally. In this configuration the breakdown occurs along the zero B-field line, which is the axis of the linear octupole magnetic field, between the anode and cathode which constitute the ends of the linear device. Breakdown could be described by a modified Townsend criterion which included additional electron losses due to the presence of the B-field transverse to the discharge.

58899 **(UPTEC—8153-E) Impurity transport in a collision-dominated rotating tokamak plasma.** Eriksson, G.; Liljegren, A. (Uppsala Univ. (Sweden)). Apr 1981. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702009.

The flux of heavy impurities is an axisymmetric, toroidal plasma with all particles in the collision-dominated regime is considered. Plasma rotation and charge-exchange with neutrals are taken into account. A hydrodynamic model employing Braginskii's transport equations is used. The therory is extended to higher collision freqencies as compared to previous treatments. It is found that the Pfirsch-Schlueter flux is significantly reduced as compared to the value given by Rutherford and that it is of the same order of magnitude, or less, than the classical flux in all regimes considered. It is also shown that the impurity flux can be influenced by charge-exchange with neutrals.

58900 **Observation of the parametric decay instability during electron cyclotron resonance heating on the Versator II tokamak.** McDermott, F.S.; Bekefi, G.; Hackett, K.E.; Levine, J.S.; Porkolab, M. (Plasma Fusion Center and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **25**: No. 9, 1488-1490(Sep 1982).

Observations are reported on a nonlinear, three-wave interaction process occurring during high-power electron cyclotron heating in the Versator II tokamak. The measured spectra and the threshold power are consistent with a model in which the incident power in the extraordinary mode of polarization decays at the upper-hybrid resonance layer into a lower-hybrid wave and an electron Bernstein wave.

58901 **Instabilities driven by the parallel variation of the electrostatic potential in tandem mirrors.** Lee, X.S.; Catto, P.J.; Aamodt, R.E. (Plasma Research Institute, Science Applications Inc., Boulder Colorado 80302). *Physics of Fluids;* **25**: No. 9, 1491-1492(Sep 1982). Contract AC03-76ET53057.

It is demonstrated that the free energy associated with the sheared flow induced by the parallel variations of drift frequencies can provide a new destabilizing term. In particular, we show the existence of a magnetohydrodynamic-like instability which may occur in the mirror end plugs or thermal barrier region of a tandem mirror fusion device.

58902 **Effect of finite aspect ratio on the neoclassical ion thermal conductivity in the banana regime.** Chang, C.S.; Hinton, F.L. (General Atomic Company, San Diego, California 92138). *Physics of Fluids;* **25**: No. 9, 1493-1494(Sep 1982). Contract AT03-76ET51011.

By considering the effect of finite aspect ratio, the neoclassical ion thermal conductivity has been found to be significantly larger than reported by Hazeltine, Hinton, and Rosenbluth. A simple correction to the expression of Hinton and Hazeltine is suggested.

58903 **Ion acoustic double layers in the presence of plasma source.** Okuda, H.; Ashour-Abdalla, M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **25**: No. 9, 1564-1569(Sep 1982). Contract AC02-76CH03073.

Steady-state plasma turbulence and the formation of negative potential spikes and double layers in the presence of ion acoustic instabilities have been studied by means of one-dimensional particle simulations in which the velocities of a small fraction of electrons are replaced by the initial drifting Maxwellian at a constant rate. A steady state is found where negative potential spikes appear randomly in space and time giving rise to an anomalous resistivity much greater than previously found. Comparisons of the simulation results with laboratory and space plasmas are discussed.

58904 **Numerical simulation of tokamak electron dynamics.** Miner, W.H.; Winsor, N.K.; Bernstein, I.B. (Science Applications, Inc., McLean, Virginia 22102). *Physics of Fluids;* **25**: No. 9, 1570-1577(Sep 1982). Contract AI01-76ET53020.

In a tokamak, the electron distribution deviates from a Maxwellian because magnetically untrapped electrons run away parallel to the applied electric field. A new method for calculating the dynamics of the electron distribution is presented. This method is novel because it can treat systems with comparable numbers of trapped and untrapped electrons, and an electric field comparable with (but smaller than) the Dreicer field. The electron distribution function and the plasma resistivity are presented for representative values.

58905 **Shear-ballooning stability analysis of low-β plasmas.** Yoshikawa, S. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08544). *Physics of Fluids;* **25**: No. 9, 1578-1582(Sep 1982). Contract AC02-76CH03073.

A model of magnetic configurations that has both shear and variation of the field curvature along the magnetic field is constructed. The stability analysis of this system is performed by expanding the perturbation function in phi$_0$ which is constant along the field and phi$_1$ which varies sinusoidally along the field line. The shear term is retained in the form of differential operations in ξ, the coordinate parallel to the pressure gradient. After several simplifications, the equation reduces to a fourth-order differential equation. The eigenvalue of this equation is obtained numerically. The calculated critical β plotted versus the well depth parameter, h, makes a smooth transition betweeen $h<0$ (maximum average B) and $h>0$ (minimum average B). Using the same technique, the nondivergent solution to the localized shear mode (Suydam mode) is also obtained by retaining the inertia term.

58906 **Decay instability of an ion-cyclotron wave in a plasma.** Sharma, O.P.; Tripathi, V.K.; Liu, C.S. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **25**: No. 9, 1598-1604(Sep 1982).

An electromagnetic ion-cyclotron wave, near the second harmonic cyclotron frequency of majority ions in the central region of a tokamak, is seen to decay efficiently into two Bernstein modes. The coupling coefficient for this decay vanishes for a dipole pump, hence a rigorous kinetic theory for decay instabilities of a finite wavenumber pump is developed. For parameters characterizing the Princeton Large Torus (PLT) experiment, the uniform medium growth rate at 200 kW turns out to be 3 μsec, whereas, the threshold due to plasma inhomogeneity is 100 kW. The nonresonant decay into ion acoustic waves is also significant, though relatively less important. For a pump wave near the cyclotron frequency of majority ions, nonlinear Landau damping and oscillating two stream instability turn out to be very important.

58907 **Equilibrium and stability of nonaxisymmetric minimum-B mirrors.** D'Ippolito, D.A.; Freidberg, J.P. (Science Applications, Inc., Plasma Research Institute, Boulder, Colorado 80302). *Physics of Fluids;* **25**: No. 9, 1617-1627(Sep 1982). Contract AC03-76ET53057.

Analytic three-dimensional mirror equilibria are calculated from the tensor-pressure fluid equations by means of an asymptotic expansion procedure. The class of equilibria described here is of interest to the minimum-B end cells of current tandem mirror experiments. It is shown that in the shallow-well approximation, a small plasma pressure can produce a relative change of order unity in the vacuum magnetic well, thereby leading to interchange instability. In addition, if the axial dependence of the quadrupole field is not chosen in a specific way, "long thin" corrections set an upper limit on the maximum allowable plasma radius. The proper choice of quadrupole field to avoid this limitation is discussed, and an analytic expression is derived for the interchange beta limit.

58908 **Acceleration of multi-species ions in CO_2 laser-produced plasmas: Experiments and theory.** Begay, F.; Forslund, D.W. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **25**: No. 9, 1675-1685(Sep 1982).

Experimental and theoretical results on the properties of CO_2 laser-induced carbon and polyethylene (CH_2) plasmas at laser intensities of $\sim 10^{15}$ W/cm^2 are presented. The Thomson parabola technique is used to measure the ion velocity distribution in the underdense expanding plasma which is collisionless and isothermal. A model which treats the problem of the collisionless expansion of an isothermal electrostatic multi-cold-ion quasineutral plasma will be used to interpret the experimental results. Experiments and theory show that the effect of hydrogen in the CH_2 target induces a cutoff in the carbon ion velocity distribution. Theory suggests that acceleration field attenuation effects modify the behavior of these plasmas. Data suggest that the space—time evolution of the ion velocity distribution is completed before an ionization-recombination equilibrium is reached. Experimental results from the underdense region are used to estimate plasma parameters near the critical surface, which show that the presence of hydrogen in the target apparently greatly reduces the thermal temperature near the critical surface, probably due to enhanced lateral energy transport.

58909 **Radio frequency current generation by waves in toroidal geometry.** Antonsen, T.M. Jr.; Chu, K.R. (Science Applications, Inc., McLean, Virginia 22102). *Physics of Fluids;* **25**: No. 8, 1295-1296(Aug 1982). Contract AI01-76ET53029.

The quasilinear generation of current by rf wave fields is investigated in toroidal geometry. A general expression is derived for the amount of current generated for a given wave-induced flux of particles. This expression should be of great practical value in assessing the various competing effects on current generation in toroidal geometry and is well-suited for implementation in a toroidal ray tracing code.

58910 **Generalized kinetic energy principle.** Van Dam, J.W.; Rosenbluth, M.N.; Lee, Y.C. (Institute for Fusion Studies, University of Texas, Austin, Texas 78712). *Physics of Fluids;* **25**: No. 8, 1349-1354(Aug 1982).

Using three single-particle adiabatic invariants, we derive an energy principle which generalizes that for the usual guiding center plasma in order to describe the low-frequency stability of a plasma containing an energetic nonhydromagnetic component (such as the annular electrons in an Elmo Bumpy Torus device).

58911 **Sufficient condition for stability of axisymmetric collisionless systems.** Walstead, A.E. (Physics Department, University of California at Los Angeles, Los Angeles, California 90024). *Physics of Fluids;* **25**: No. 8, 1358-1364(Aug 1982). Contract AM03-76SF00010.

A sufficient condition for the stability of an axisymmetric mirror machine is obtained using the guiding center plasma model. The criterion is particularly suited to configurations with comparable transverse and longitudinal length scales, so-called short, fat equilibria. Under this ordering, the stabilizing effects of plasma compression is significant. These effects are included through the use of a positive definite lower bound on their contribution to an energy principle.

58912 **Free boundary field-reversed configuration (FRC) equilibria in a conducting cylinder.** Spencer, R.L.; Hewett, D.W. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **25**: No. 8, 1365-1369(Aug 1982).

Highly elongated field-reversed configuration (FRC) equilibria are computed in a straight conducting cylinder for the pressure profile p'(psi) = cH(psi), where H(x) is the Heaviside function. The equilibria are found by inverting the Grad—Shafranov equation by means of a Green's function and by solving the resulting nonlinear integral equation. Long equilibria are obtained only for values of the constant c very near a critical value: the equilibria change from 2:1 elongated to infinitely long as c varies by only 0.3%. This criticial value of c is predicted by the average beta condition.

58913 **Ideal magnetohydrodynamic stability limits of a high-β tokamak with superimposed helical fields.** Sherwell, D.; Freidberg, J.P.; Berge, G. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **25**: No. 8, 1370-1383(Aug 1982).

The stability of a high-β tokamak with a superimposed single helicity stellarator field is investigated in the context of the sharp boundary surface current model. The analysis treats external ideal magnetohydrodynamic modes including both pressure-driven ballooning effects and current-driven kink instabilities. The results show that the addition of an $l = 2$ field is unfavorable, lowering the allowable Ohmic heating current and decreasing the maximum stable β. The addition of an $l = 3$ field, however, is favorable. Both the allowable Ohmic heating current and maximum stable β are increased as the $l = 3$ amplitude increases.

58914 Parametric instabilities of electron cyclotron waves in plasmas. Tripathi, V.K.; Liu, C.S. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **25**: No. 8, 1388-1392(Aug 1982).

The parametric instabilities of electron cyclotron waves in (i) the EBT ring and (ii) the large tokamaks, e.g., PLT, have been studied. In EBT, the electron cyclotron pump of finite wavenumber k_0 decays into two Bernstein modes at the second harmonic cyclotron layer and can account for the heating of the ring in the initial phase. The coupling coefficient for this decay vanishes for a dipole pump, whereas the convective threshold with finite k_0 is approximately 200 W/cm^2. For large tokamaks, the convective threshold for various decay channels turns out to be approximately 200 kW/cm^2 at 3 mm wavelength.

58915 Direct-interaction approximation and statistically steady states of three nonlinearly coupled modes. Krommes, J.A. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08544). *Physics of Fluids;* **25**: No. 8, 1393-1395(Aug 1982). Contract AC02-76CH03073.

The direct-interaction approximation is used to find statistically steady states of a system of three modes with complex frequencies coupled by a quadratic nonlinearity. These states are compared to the exact predictions of an ensemble of realizations with Gaussian distributed initial conditions. The direct-interaction approximation is shown to be reasonably successful in this context.

58916 Stimulated Raman scattering in large plasmas. Phillion, D.W.; Banner, D.L.; Campbell, E.M.; Turner, R.E.; Estabrook, K.G. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **25**: No. 8, 1434-1443(Aug 1982). Contract W-7405-ENG-48.

In long pulse, high-energy experiments (4000 J, 2 nsec, 5 x 10^{14} W/cm^2, 1.064 μm) at the Shiva laser facility, several percent of the laser light has been observed to be Raman scattered. The spectrum of the Raman-scattered light was measured from 1.48 to 2.17 μm. The Raman scattering occurred principally at electron densities much lower than the quarter-critical electron density. The high-energy electrons expected in Raman scattering were observed indirectly in these experiments via their bremsstrahlung radiation. Additional experiments show that the Raman instability has a much lower intensity threshold for longer laser pusle length and larger laser spot size. Raman light measurements for 5320 A irradiated disk target experiments are also reported. The light near $2\lambda_0$ or 1.064 μm had both a red- and blue-shifted component. At high intensities, Raman scattering also occurred in the very underdense plasma.

58917 Influence of molecular nitrogen upon plasma channel formation by laser resonance saturation. Measures, R.M.; Wong, S.K.; Cardinal, P.G. (Institute for Aerospace Studies, University of Toronto, 4925 Dufferin Street, Downsview, Ontario, Canada M3H 5T6). *Journal of Applied Physics;* **53**: No. 8, 5541-5551(Aug 1982).

Laser resonance saturation of alkali vapors represents a very attractive method of creating the extended plasma channels of interest in light ion beam fusion. We have undertaken a preliminary study of the influence of molecular nitrogen upon this laser ionization technique. Our results indicate that the electron cooling, resonance quenching, and the increase in the laser energy requirement are acceptable, providing that the alkali seeding exceeds 0.5%.

58918 Ideal magnetohydrodynamic theory of magnetic fusion systems. Freidberg, J.P. (Department of Nuclear Engineering and Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Reviews of Modern Physics;* **54**: No. 3, 801-902(Jul 1982).

Ideal magnetohydrodynamic theory and its application to magnetic fusion systems are reviewed. The review begins with a description and derivation of the model as well as a discussion of the region of validity. Next, the general properties are derived. These are valid for arbitrary geometry and demonstrate the inherently sound physical foundation of the model. The equilibrium behavior of the currently most promising toroidal magnetic fusion concepts are then discussed in detail. Finally, the stability of such equilibria is investigated. Included are discussions of the general stability properties of arbitrary magnetic geometries and of detailed applications to those concepts of current fusion interest.

58919 Ion heating and confinement in a toroidal plasma device with a cusped magnetic field. Rhodes, M.; Dawson, J.M.; Le Boeuf, J.N.; Luhmann, N.C. Jr. (University of California at Los Angeles, Los Angeles, California 90024). *Physical Review Letters;* **48**: No. 26, 1821-1824(28 Jun 1982). Contract AM03-76SF00010;AT03-76ET53019.

A novel toroidal plasma device has been tested in which the plasma is confined in a surfacelike multipole cusp field generated by permanent magnets. A toroidal current, driven by an induced electric field, is preferentially carried by the ions which are directly Ohmically heated (T/sub i/>T/sub e/). Plasma β's of 20%—30% have been observed. Computer simulations verify a simple model of device operation.

58920 Radio-frequency current drive in a fusion-producing plasma. Bhadra, D.K.; Chu, C. (General Atomic Company, San Diego, California). *Physical Review Letters;* **48**: No. 26, 1824-1828(28 Jun 1982). Contract AT03-76ET51011.

A method for driving current in a fusing plasma is proposed. Radio-frequency power is used to prohibit fusion-produced energetic particles from slowing down isotropically or to push them in a preferential direction. As a result, a net plasma current is generated whose efficiency is comparable to other current-drive schemes.

58921 Spectrum of small-scale density fluctuations in tokamaks. Mazzucato, E. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physical Review Letters;* **48**: No. 26, 1828-1830(28 Jun 1982). Contract AC02-76CH03073.

The power spectrum of plasma density fluctuations in the range of frequencies of drift waves has been investigated in the Princeton Large Torus tokamak. The results suggest that the observed fluctuations evolve to a strong nonlinear state, and therefore they emphasize the need for a complete nonlinear theory of drift waves in tokamaks to assess their effects on plasma transport.

58922 Current maintenance in tokamaks by use of synchrotron radiation. Dawson, J.M.; Kaw, P.K. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review Letters;* **48**: No. 25, 1730-1733(21 Jun 1982). Contract AM03-76SF00010;AC02-76CH03073.

A tokamak at fusion temperatures generates large amounts of synchrotron radiation. By proper configuration of the walls, this radiation can sustain the current. This is accomplished by a fish-scale wall that preferentially reflects radiation propagating in one direction while absorbing that going oppositely. The wall transfers momentum to the electrons through radiation pressure. A rough theoretical treatment shows that at high temperatures (30—50 keV) sufficient current for a steady-state tokamak may be driven.

58923 Multichannel grazing-incidence spectrometer for plasma impurity diagnosis: SPRED. Fonck, R.J.; Ramsey, A.T.; Yelle, R.V. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08544). *Applied Optics;* **21**: No. 12, 2115-2123(15 Jun 1982). Contract AC02-76CH03073.

A compact vacuum ultraviolet spectrometer system has been developed to provide time-resolved impurity spectra from tokamak plasmas. Two interchangeable abberation-corrected toroidal diffraction gratings with flat local fields provide simultaneous coverage over the ranges 100-1100 A or 160-1700 A. The detector is an intensified self-scanning photodiode array. Spectral resolution is 2 A with the higher dispersion grating. Minimum readout time for a full spectrum is 20 msec, but up to seven individual spectral lines can be measured with a 1-msec time resoiution. The sensitivity of the system is comparable with that of a conventional grazing-incidence monochromator.

58924 **Surface plasma absorption in an integrating sphere at high optical flux levels.** Kristal, R. (University of California, Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, New Mexico 87545). *Applied Optics;* **21**: No. 11, 1885-1887(1 Jun 1982).

An integrating sphere has been used for laser target reflectivity measurements and nonlinear calibration curve for target surface plasma absorption was determined. (AIP)

58925 **Normal modes and symmetries of the Rayleigh-Taylor instability in stratified fluids.** Mikaelian, K.O. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **48**: No. 19, 1365-1368(10 May 1982). Contract W-7405-ENG-48.

A formalism is presented for calculating all the normal growth modes of the Rayleigh-Taylor instability in a stratified fluid of arbitrary profile. The classical instability is suppressed by the introduction of a finite density gradient at the interface, a technique applicable to inertial confinement fusion targets.

58926 **ICP emission spectrometry: On the selection of analytical lines, line coincidence tables, and wavelength tables.** Winge, R.K.; Fassel, V.A.; Peterson, V.J.; Floyd, M.A. (Ames Laboratory, United States Department of Energy, Iowa State University, Ames, Iowa 50011). *Applied Spectroscopy;* **36**: No. 3, 210-221(May 1982). Contract W-7405-ENG-82.

A thorough knowledge of the spectral emission characteristics of the inductively coupled plasma is a prerequisite for its maximum utilization in atomic emission spectroscopy. Toward this end on Atlas of Spectral Information for Inductively Coupled Plasma, Atomic Emission Spectroscopy has been assembled to provide the analyst with the basic information concerning the analytical capabilities and the potential spectral interferences of the prominent spectral lines of 70 elements. The Atlas contains 232 wavelength scans of 70 elements covering the range of 189 to 517 nm (189 to 597 nm for sodium and the reference blank).. The Atlas also contains a listing of 973 prominent lines with estimated detection limits and a detailed collection of coincidence profiles for 281 of the most prominent lines, each with profiles of ten of the most prevalent concomitant elements superimposed. This paper contains a survey of the spectral information contained in the Atlas.

58927 **Implicit time integration for plasma simulation.** Cohen, B.I.; Langdon, A.B.; Friedman, A. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Computational Physics;* **46**: No. 1, 15-53(Apr 1982). Contract W-7405-ENG-48.

To increase the size of the time step, and threrby extend the applicability of kinetic plasma simulation, analysis of the stability and accuracy of implicit time integration schemes for plasma particle-in-cell simulation and the synthesis of new algorithms have been undertaken. Three classes of implicit algorithms are considered in general form. Stability and accuracy calculations provide guidelines for the design and application of implicit simulation algorithms, as illustrated in the construction of new difference schemes with desirable properties. Of particular interest are the relaxation of stability constraints on the time step, strong damping of unwanted high-frequency modes, accuracy of the simulation of low-frequency phenomena, numerical secular acceleration, and numerical stability of fast and slow space-charge waves. The potency of higher order accurate differencing schemes in reducing undesirable numerical effects is demonstrated.

58928 **Numerical model for nonaxisymmetric MHD instabilites.** Shestakov, A.I.; Killeen, J.; Schnack, D.D. (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Computational Physics;* **46**: No. 1, 69-96(Apr 1982). Contract W-7405-ENG-48.

A method is described for studying the stability of two-dimensional equilibria of magnetically confined plasmas. The equations of magnetohydrodynamics (MHD) are linearized and the resulting time-dependent first-order system of equations is solved. Unstable equilibria result in exponentially growing solutions. The plasma is assumed to be incompressible and resistivity is included in the model. The equations are solved in cylindrical coordinates and the perturbations vary as $f_1(r,z,t)$ exp(inθ). Nonaxisymmetric modes (nnot =0) are considered. Tearing mode results for one-dimensional analytic equilibria are compared with earlier work. A numerically generated equilibrium, modeling the field reversed theta pinch experiment, is shown to be unstable to the $n = 1$ tilting mode.

58929 **Recent use of the Thomson parabola ion analyzer.** Anthes, J.P. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physics Teacher;* **20**: No. 3, 161-164(Mar 1982).

The ablation depth of a laser target is measured as a function of laser intensity. (AIP)

58930 **(FUPH-R—175) Magnetoacoustic oscillations as a plasma-diagnostic technique for a current-carrying plasma column.** Brennan, M.H.; McCarthy, A.L.; Sawley, M.L. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Oct 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82903314.

Portions of document are illegible.

Magnetoacoustic oscillations were excited in a non-uniform, current-carrying plasma column. Measurements of the oscillating axial magnetic flux at a number of excitation frequencies were used to determine the equilibrium plasma properties. In agreement with previous theoretical studies, the radial profile of the plasma density is shown to be accurately determined, while it is not possible to obtain detailed information on the radial profile of the equilibrium magnetic field.

58931 **Weak double layers.** Hershkowitz, N.; Payne, G.L.; DeKock, J.R. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy); Chan, C. (Iowa Univ., Iowa City (USA). Dept. of Electrical and Computer Engineering). *Plasma Physics;* **23**: No. 10, 903-925(Oct 1981).

The characteristics of weak double layers with potential steps eΔphiTsub(e) approximately equal to 5 are studied in a triple plasma device and compared with a kinetic model. Very one-dimensional laboratory double layers are produced and an explanation is given of many of the features of the laboratory double layers using a one-dimensional kinetic model. The model calculations illustrate the role of the trapped ions in determining the position of the double layer, and they show the dependence of the length of the double layer on the entering ion and electron fluxes. Ion beams are found to have velocities much greater than the Bohm velocity. It is found that the characteristics of weak double layers are more sensitive to the boundary conditions.

58932 **Interferometric measurements of plasma density fluctuations during the formation phase in the ZT-40 reversed-field pinch.** Jacobson, A.R. (Los Alamos National Lab., NM (USA)). *Plasma Physics;* **23**: No. 10, 927-947(Oct 1981).

A seven-chord infrared interferometer is used to study plasma density fluctuations during the formation phase in the ZT-40 toroidal pinch device. The mean quantities are found to depend systematically on the level of magnetic shear in the pinch discharge, in a manner which suggests that the density disturbances are elongated structures oriented parallel to the local magnetic field. The spatial correlation results are compared with earlier work on the Zeta device.

58933 **Nonlinear evolution of the sheet pinch.** Matthaeus, W.H.; Montgomery, D. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics). *Journal of Plasma Physics;* **25**: 11-41(Feb 1981).

An incompressible, dissipative numerical code of the spectral type is used to follow the nonlinear evolution of a magnetohydrodynamic sheet pinch in two spatial dimensions. The evolution involves considerable turbulent activity in the electric current field, with the excited spatial scales ranging from the size of the containing volume down to the dissipation lengths of the magnetic and velocity fields. Strong current filamentation near magnetic X-points is observed, as is 'jetting', or expulsion of magnetofluid from the vicinity of the X-point parallel to the current sheet.

58934 **Three electrostatic temperature drift instabilities.** Gary, S.P.; Abraham-Shrauner, B. (Los Alamos Scientific Lab., NM (USA)). *Journal of Plasma Physics;* **25**: 145-159(Feb 1981).

Temperature drift instabilities, modes which can be driven unstable solely by a temperature gradient perpendicular to a magnetic field are considered. The linear electrostatic dispersion relation for a Vlasov plasma in a uniform magnetic field is used and propagation is assumed to be in the plane perpendicular to the gradient. Three temperature drift instabilities are found. The ion temperature drift instability arises at frequencies much below the ion cyclotron frequency, the electron temperature drift instability propagates somewhat below that frequency and the lower-hybrid temperature drift instability has frequencies above the lower-hybrid frequency. The first of these modes is driven by an ion temperature gradient and is enhanced by increasing Tsub(e)/Tsub(i). The latter two modes are driven by an electron temperature gradient and are enhanced by a decreasing Tsub(e)/Tsub(i). Density gradients are considered as an additional source of free energy, and comparisons of temperature drift with density drift instabilities are made.

58935 **Approach to rapid plasma shape diagnostics in tokamaks.** Lee, D.K.; Peng, Y.K.M. (Oak Ridge National Lab., TN (USA)). *Journal of Plasma Physics;* **25**: 161-173(Feb 1981).

A diagnostic procedure which allows the plasma boundary shape and location in a tokamak to be estimated by using numerical values of the poloidal magnetic flux function psi in the vicinity of the plasma is described. In the case of the Impurity Study Experiment (ISX-B) tokamak, the magnetic sensor coils located around the periphery of the vacuum chamber provide information on deltaBsub(R)/deltat and deltaBsub(Z)/deltat, which can be processed to obtain data on psi (and deltapsi/deltan) through the relation Bsub(R) = -R^{-1}deltapsi/deltaZ and Bsub(Z) = R^{-1}deltapsi/deltaR. This leads to a Cauchy boundary condition for the Grad-Shafraov equation Δ^*psi = O in the region between the contour of the sensor coil locations and the plasma boundary flux surface. Numerical equilibria calculated for the ISX-B with different shapes are used to simulate psi data along the coil locations. Random errors are added to the data to test the efficacy of two different approaches: global fitting and local fitting. Reasonably accurate results are obtained by the method of global fitting of the boundary values, which is based on the expansion of psi in terms of eigenfunctions of Δ^*psi = O in a toroidal ring co-ordinate system. This approach is found to permit a relatively large random error in poloidal B field values at the sensor coils and appears to have the potential of rapidly displaying the plasma shape and location.

58936 **Fat banana carrier injection for electric field generation in tokamaks.** Downum, W.B.; Miley, G.H. (Univ of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **39**: 243-244(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

58937 **Burn performance of inertial confinement fusion targets.** Blue, T.E.; Choi, C.K.; Hardy, C.R.; Harris, D.B.; Miley, G.H. (Univ of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **39**: 245-246(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

58938 **Density profiles in tokamaks from electron cyclotron radiation spectra.** Boyd, D.A. (Maryland, University, College Park, Md.). *International Journal of Infrared and Millimeter Waves;* **1**: 45-55(1980).

Measurement of the line shape of optically thick and optically thin lines in the electron cyclotron radiation spectrum emitted by a tokamak plasma may yield both electron temperature and density profiles. Currently temperature profiles are routinely extracted from optically thick lines. Consequently, this paper is addressed to the density profile problem. Algorithms for extracting density profiles are outlined in the case of uncontrolled reflection and controlled reflection of the cyclotron radiation within the tokamak vacuum chamber.

58939 **(UCRL-Trans—11780) Numerical model of particle motion in an axially nonsymmetric plasma trap.** **Lysyanskiy, P.B.; Tiunov, M.A.; Fomel, B.M. (Lawrence Livermore National Lab., CA (USA)). 1979. Contract W-7405-ENG-48. Translation of Institute of Nuclear Physics, SO AN SSSR, preprint 79-64, Novosibirsk, pp 1-19, Russian. 31p. NTIS, PC A03/MF A01. Order Number DE82019541.**

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Computations have been conducted of transverse particle motion in a model magnetic trap without axial symmetry. Under the model the azimuthal particle motion was considered due to the radial electric field in the plasma and also elastic particle scattering. A method has been developed for determining the reflection function in the mirrors of a realistic trap. Neoclassical diffusion has been studied in the model trap and in the central cell of the planned trap AMBAL-I.

58940 **Determination of plasma ion temperatures by analysis of charge-exchange neutrals.** Eubank, H.P. (Princeton University, Princeton, NJ). pp 7-16 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper discusses the principles and techniques by which analysis of the fast neutrals produced by charge exchange in the plasma volume can be used to determine the plasma ion temperature. The fast neutral flux emerging from the plasma interior declines sharply with increasing density and minor radius due to both a drop in the neutral density within the plasma interior as well as attenuation of the outgoing flux. Methods for artificially enhancing the neutral density with spatial resolution adequate for ion temperature profile measurements are considered. Neutral beam heating experiments have necessitated fast neutral measuring systems containing both momentum and energy analysis in order to distinguish the thermal plasma from the slowing down distribution of beam particles. This has enabled measurements on PLT of the thermal species, e.g., D(+), to be extended into the energy range where the beam particles H(+) are orders of magnitude more abundant.

58941 **Particle beam systems in plasma diagnostics.** Eubank, H.P. (Princeton University, Princeton, NJ). pp 17-34 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper reviews basic principles of active beam systems in plasma diagnostics, with emphasis on systems for the measurement of plasma potential, and current and impurity profiles. Attention is given to the following: determination of ion density and Zeff beam dissociation and optical techniques heavy ion beam probes and tangentially injected neutral beam probes.

58942 **Diagnostics for mirror machines.** Osher, J.E. (California University, Livermore, CA). pp 47-77 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979). Contract W-7405-ENG-48.

From International school of plasma physics; Varenna, Italy (Sep 1978).

The neutral-beam-heated quasi-dc mirror confinement systems are described and a general example of mirror diagnostics is given by a discussion of the diagnostics used on the 2XIIB experiment at the Lawrence Livermore Laboratory. Mirror machine diagnostics are then developed in more detail and attention is given to the special diagnostic needs of future mirror machines emphasis is placed on diagnostics involving the higher-power neutral beams to be used with these future machines.

58943 **Soft X-ray measurements.** Von Goeler, S. (Princeton University, Princeton, NJ). pp 79-109 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper considers measurements of soft X-ray emission from tokamaks and other low-beta confinement devices, with emphasis on the interpretation of data and on the techniques used for large machines. Typical X-ray spectra for tokamaks are presented and attention is given to basic processes which contribute to their formation. This is followed by a discussion of measurements of the impurity parameter Zeff, ultrasoft X-ray radiation, and ion temperature. X-ray fluctuation measurements and experimental results on the disruptive instability are also discussed.

58944 **Iron radiation in tokamak discharges.** Hinnov, E. (Princeton University, Princeton, NJ). pp 139-148 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

Iron ion resonance-line intensity measurements are described as a representative sample of spectroscopic diagnostics of tokamak plasmas. A brief outline of the tokamak discharge characteristics is followed by a description of the spectrometer, and its calibration for absolute intensity measurements in the vacuum ultraviolet wavelength region. Then iron ion resonance lines in the wavelength range 90-360 A, from ionization states FeXV through FeXXIV, are shown as observed in the PLT tokamak. A discussion of the principal excitation processes leading to the emission of these lines in tokamak-type plasmas, and of the appropriate atomic cross-sections and rate coefficients, is then followed by quantitative measurements of these emissions in time and space in a PLT tokamak discharge. The results are interpreted in terms of iron ion concentrations, their behavior in the discharge, and their implications to radiative energy loss, contributions to electrical resistivity, and ion confinement times in the plasma.

58945 **Thomson scattering.** Dimock, D. (Princeton University, Princeton, NJ). pp 271-301 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper presents some aspects of Thomson scattering measurements from a viewpoint of an experimentalist. The theory underlying Thomson scattering from plasmas is outlined, and plasma from the incoherently scattered light is discussed, including the advantages and limitations of these techniques. Details of the practical experimental realization of Thomson scattering measurements and methods of solving problems inherent in these techniques are described. Finally, information that can be obtained using coherent Thomson scattering is examined, and some signal to noise problems of these methods are considered.

58946 **On the physics of strong turbulence for electron plasma waves.** Papadopoulos, K. (U.S. Navy, Naval Research Laboratory, Washington, DC). pp 355-365 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

Research related to the new physics of the so-called strong Langmuir turbulence and the dynamics involved is still in a rudimentary stage. It appears that the transition of a plasma to a state of strong turbulence is in a sense similar to a phase transition where several modes combine to form some kind of cluster. The most reasonable approach to understanding the properties of this new turbulent state should rely on a combination of computational, quasi-analytic, and experimental investigations. The existence of a spiky state has already been observed both in the laboratory and in space. In the present paper, an attempt is made to present some of the properties and consequences of the strong turbulence theory, as they are currently understood, with a view to their importance in the development of plasma diagnostics.

58947 **Neutron diagnostics.** Eubank, H.P. (Princeton University, Princeton, NJ). pp 403-420 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

Neutron production in Maxwellian plasmas of deuterium ions is discussed from the standpoint of an ion temperature diagnostic. Expressions for the cross sections and reactivities vs temperature are presented. Distortions to the neutron producing tail of the distribution which can lead to erroneous 'temperature' are discussed along with processes which lead to non-thermonuclear neutron production. Fast neutron counting with good energy resolution is considered in the light of neutral beam injection heating and/or high ion temperatures as a means of deducing beam energy distributions and temperatures. Experimental results from PLT are presented to illustrate current techniques and problems in interpretation of the ion temperature.

58948 **Interferometric measurement of plasma density in high-beta plasmas.** Quinn, W.E. (California University, Los Alamos, NM). pp 421-432 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper examines holographic and coupled-cavity interferometry for measuring the plasma electron density. In the application of holography to plasma interferometry the hologram makes possible storing a complete phase and amplitude information on the plane light wave passing through a plasma region. A laser beam is divided into a scene beam directed through the plasma and a reference beam passing outside the plasma. A double exposure, one without plasma and one with plasma in the scene beam, results in a holographic interferogram which can be reconstructed in white light. The coupled-cavity laser interferometer is particularly applicable to the measurement of pulsed plasma densities because the intensities of the laser output is modulated if a small fraction of a gas laser's output radiation is reflected into the laser with an external mirror.

58949 **Measurement of plasma beta in high beta fusion experiments.** Quinn, W.E. (California University, Los Alamos, NM). pp 433-446 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

It is possible to infer the beta profile by combining measurements of the magnetic flux excluded by the plasma column and the radial plasma luminosity distribution. This technique has been used extensively in linear magnetic fusion experiments such as the theta pinch. The excluded flux is measured by a balanced loop-probe arrangement and a relative density profile is obtained from a multichannel luminosity profile apparatus. These measurements give the plasma beta, radius, position, and energy line density, and when combined with a single-chord density measurement, the absolute density profile and total plasma temperature.

58950 **Faraday rotation measurements in high-beta fusion experiments.** Quinn, W.E. (California University, Los Alamos, NM). pp 447-458 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

Faraday rotation is the rotation of the direction of polarization of a plane-polarized electromagnetic wave as it propagates parallel to a magnetic field in a plasma-magnetic field medium. The Faraday rotation measurement, described in the present paper, uses a 1.5-mm diam He-Ne laser beam (6328 A) as a plasma-magnetic field probe, and a calcite Wollaston prism as the polarization analyzer with silicon diode detectors. The rotation is a small effect at optical wavelengths even for substantial densities and fields. The rotation is proportional to the square of the probing wavelength, which suggests the use of infrared laser wavelengths.

58951 **Particle-beam fusion experiments and diagnostics.** Wharton, C.B. (Cornell University, Ithaca, NY). pp 459-481 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper examines particle-beam fusion experiments and diagnostics. Two experimental approaches, pellet-compression and the long solenoid are considered, describing two proposed break-even experiments, and some of the source, target, and diagnostic requirements. High power ion developments are analyzed and applications are discussed. Some diagnostics problems and useful techniques in overcoming them are outlined these techniques are different from those used in other fusion experiments because of the short time scales and large power levels encountered. Beam-plasma long solenoid experiments, intense ion beam accelerators, magnetic measurements of beam-plasma interactions, and nuclear reactions are examined.

58952 **Laser fusion diagnostics.** Coleman, L.W. (California University, Livermore, CA). pp 483-509 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979). Contract W-7405-ENG-48.

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper reviews laser fusion diagnostics whose goal is to make measurements over large ranges of physical parameters with space-time resolutions of 1 micron and 1 psec. Various laser fusion diagnostics techniques including optical, ultraviolet probing, and X-ray are discussed, and high temporal and spatial resolution optical diagnostics of laser performance, energy balance, and applicable plasma probing techniques are reviewed. Spatially, temporally, and spectrally resolved X-ray diagnostics methods and instruments are examined, with emphasis on high spatial resolution imaging and applications, and on high temporal resolution X-ray streak camera applications to exploding pusher target experiments. Finally, particle diagnostics and systems designed to diagnose target performance via yield and temperature measurements to determine the characteristics of compressed targets are considered.

58953 **Data acquisition.** Wing, W.R. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 525-566 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

A three lecture overview on the hardware and software necessary to assemble a useful data acquisition system for pulsed fusion experiments is presented. Attention is given to the Oak Ridge Data System, where diagnostics are divided into two categories: development and monitor diagnostics. The data system project supports two analysis packages and one set of FORTRAN-callable subroutines. It is determined that the system provides relative isolation between diagnostics. The CAMAC complete set of standards is examined, specifying the mechanical and electrical properties of the CAMAC compatible hardware.

58954 **The study of plasma formation in fusion devices.** Bengtson, R.D. (Texas University, Austin, TX). pp 581-600 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

The atomic and plasma physics processes important in the formation of a plasma will be discussed. Diagnostic techniques important in this regime such as electron velocity analyzers, spectroscopy, electric and magnetic probes will be presented. Examples from a toroidal machine will be given and compared with a zero dimensional model of plasma formation.

58955 **Measurements of wall impurity concentrations during tokamak discharges.** Schwirzke, F. (U.S. Naval Postgraduate School, Monterey, Calif.); Oren, L. (California University, Los Angeles, Calif.). pp 601-615 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

Impurities released by plasma-surface interactions play a major role in influencing the performance characteristics of many of today's tokamaks. A new laser probing technique has been developed to determine the concentration of loosely bound impurities present on the surface at any time during the tokamak discharge. Surface spot heating by a laser pulse induces desorption of loosely bound species. Coincident spectroscopic measurements of the locally increased inpurity radiation show the species and amount of impurities which were present on the surface. The first laser shot onto a new surface produces a large impurity influx into the plasma, while consecutive laser shots produce much smaller signals. These results reveal the existence of loosely bound chromium and iron on tokamak surfaces.

58956 **New techniques for plasma density profiling.** Kristal, R. (California University, Los Alamos, NM). pp 617-636 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979).

From International school of plasma physics; Varenna, Italy (Sep 1978).

Two new techniques for the measurement of plasma density profiles are presented. The two approaches are aimed at simultaneously overcoming uncertainties due to the Abel inversion and plasma irreproducibility. The first technique combines standard heterodyne interferometry with rapid spatial scanning. The Abel inversion problem is addressed by the very high spatial resolution obtainable, while the plasma irreproducibility is overcome by multiple framing in a single discharge. The technique requires only a single detector channel and is applicable over a wide range of parameters. The apparatus has been built and successfully bench tested. The second technique, currently in the design stage, is based on Thomson scattering of a short laser pulse. With a wavepacket small compared to the plasma, the nondispersed scattered light pulse shape is essentially the plasma profile. Additionally, the short light pulse allows time of flight discrimination against instrumental scatter. With very modest pulse energy, the scattered power greatly exceeds the plasma radiation and signal statistics determine the detection quality.

58957 **Fiber optic applications in plasma diagnostics.** Lyons, P.B. (California, University, Los Alamos, N. Mex.); Looney, L.D. (EG G, Inc., Goleta, Calif.). pp 388-395 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

The advantages and applications of optical fiber data transmission in radiation diagnostics are considered. The individual components of such a system are each discussed. Only passive systems utilizing a direct radiation-to-light conversion are studied. The development of new scintillators with long wavelength emission characteristics was critical to such application and scintillators with a FWHM of 1.4 ns and significant output at 600 nm have been achieved. Cerenkov converters also are used in high bandwidth systems. System examples using scintillators are given, which show a bandwidth exceeding 100 MHz over distances of almost 200 m (with a dynamic range of 40,000) or 500 m (with a dynamic range exceeding 100). With a Cerenkov converter, system examples show a bandwidth approaching 1 GHz over 1 km fiber lengths. Experimental data that illustrate both systems will be shown.

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REFER ALSO TO CITATION(S) 56822, 56854, 56855, 56855, 56865, 56866, 56867, 56992, 57322, 57524, 57753, 57771, 57885, 57900, 57901, 57903, 57931, 57941, 57950, 58398, 58398, 58824, 58924, 58937, 58952

58958 **(AD-A—108935/8) The development of high-intensity negative ion sources and beams in the USSR. Technical report.** Wells, N. (RAND Corp., Santa Monica, CA (USA)). Sep 1981. 81p. (RAND/R—2816-ARPA). NTIS, PC A05/MF A01.

This report reviews Soviet R and D of (1) high-intensity negative ion sources and (2) transport and focusing of negative ion beams, using Soviet open literature of the past ten years, and correlates this data with data on Soviet institutes responsible for negative ion beam development. The Soviets are developing intense negative ion beams as the basis for creating neutral beams for injection into mirror traps and tokamaks, for inertial confinement fusion, and possibly for exoatmospheric beam weapon applications. The report focuses specifically on surface-plasma-type ion sources, which were first developed in the USSR and which show great promise for creating beams of high intensity, high brightness, and low emittance. Mechanisms for optimum negative ion beam transport are also discussed.

58959 **(AD-A—109854/0) Coalescence of spheromaks.** Reiman, A. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). Jul 1981. 45p. (PL—82-005; PUB—82-021). NTIS, PC A03/MF A01.

The coalescence of two spheromaks is described using the quasi-ideal model of reconnection. Nonaxisymmetric effects are found to play an important role in general. Possible applications of repeated coalescence are studied, including heating the spheromak plasma, building up a large spheromak from smaller ones, and maintaining a spheromak in steady state. The analysis suggests that coalescence experiments could also provide a valuable method for studying magnetic field relaxation.

58960 **(AD-A—111663/1) Ion diode research on the Aurora accelerator. Final report 5 Jan 81-5 Jan 82.** Meger, R.A. (JAYCOR, Alexandria, VA (USA)). 27 Jan 1982. 175p. NTIS, PC A08/MF A01.

Within the last few years interest in ion beams for inertial confinement fusion (ICF) applications has increased significantly. The Naval Research Laboratory (NRL), with support from JAYCOR, has been in the forefront of that research effort. The ion source which NRL has concentrated on is known as the pinch reflex diode (PRD). This type of ion diode was originated at NRL with JAYCOR assistance and is presently one of the few designs with application to ICF. The PRD, is comprised of a hollow cylindrical cathode of radius R separated from a plasma anode by a diode gap D. When a voltage is placed across the gap, electrons emitted from the cathode are accelerated toward the anode while being pinched toward the axis by their own magnetic field. The anode is normally made of a disk of thin dielectric material connected to a conducting backplate by a small conducting cylinder on axis. Electrons hitting the anode pass through and are reflexed back into the diode gap by the magnetic field from the current driven in the central button. Electrons undergo the combined reflexing and pinching motion until they are collected by the central button. Ions from the plasma formed on the front surface of the dielectric anode due to electron heating or flashover mechanisms are accelerated across the diode gap toward the cathode. The relative ion and electron current densities depend on the difference in crossing times of the two charge species. For diode voltages in the 1-10 MV range the ions move in nearly straight line trajectories at nonrelativistic velocities while the electrons are quickly accelerated to near the speed of light.

58961 **(CEA-CONF—6066) Proton beam - target interactions at low and high power densities.** Duborgel, B.; Dufour, J.M.; Gouard, P. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Oct 1981. 15p. (CONF-811028—14). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702259.

From 23. annual meeting of the division of plasma physics of the APS; New York, NY, USA (12 Oct 1981).

Interaction of light ions beams with various targets is calculated from an ion energy deposition model coupled with an hydrodynamic code, taking account of the plasma evolution during the target heating. The calculations are made in two cases: at low power densities available on a laboratory machine as SIDONIX, at high power densities required for pellet fusion. In the case of low power densities the requirements of a neutron target implosion experiment are discussed. The simulation of deposition processes at high power densities shows that the energy deposition characteristics are strongly modified during the target heating.

58962 **(CONF-801237—) Proceedings of the meeting on electrical insulators fusion magnets.** (USDOE Office of Energy Research, Washington, DC. Development and Technology Div.). Nov 1981. 334p. NTIS, PC A15/MF A01. Order Number DE82006199.

From Meeting on electrical insulators for fusion magnets; Germantown, MD, USA (15 Dec 1980).

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Separate abstracts were prepared for each of the 20 included sections. (MOW)

58963 **(DOE/ER—0046/7) Damage analysis and fundamental studies. Quarterly progress report, July-September 1981.** (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1981. Contract AC06-76FF02170. 256p. NTIS, PC A12/MF A01. Order Number DE82006098.

Portions of document are illegible.

This report is the fifteenth in a series of Quarterly Technical Progress Reports on Damage Analysis and Fundamental Studies (DAFS), which is one element of the Fusion Reactor Materials Program, conducted in support of the Magnetic Fusion Energy Program of the US Department of Energy (DOE). The first eight reports in this series were numbered DOE/ET-0065/1 through 8. Other elements of the Materials Program are: (1) Alloy Development for Irradiation Performance (ADIP), (2) Plasma-Materials Interaction (PMI), and (3) Special Purpose Materials (SPM). This report is organized along topical lines in parallel to a Program Plan of the same title so that activities and accomplishments may be followed readily, relative to that Program Plan. Thus, the work of a given laboratory may appear throughout the report. The Table of Contents is annotated for the convenience of the reader.

58964 **(DOE/ER—0113) Special-purpose materials for magnetically confined fusion reactors. Third annual progress report.** (USDOE Office of Energy Research, Washington, DC. Development and Technology Div.). Nov 1981. 114p. NTIS, PC A06/MF A01. Order Number DE82005310.

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The scope of Special Purpose Materials covers fusion reactor materials problems other than the first-wall and blanket structural materials, which are under the purview of the ADIP, DAFS, and PMI task groups. Components that are considered as special purpose materials include breeding materials, coolants, neutron multipliers, barriers for tritium control, materials for compression and OH coils and waveguides, graphite and SiC, heat-sink materials, ceramics, and materials for high-field (>10-T) superconducting magnets. It is recognized that there will be numerous materials problems that will arise during the design and construction of large magnetic-fusion energy devices such as the Engineering Test Facility (ETF) and Demonstration Reactor (DEMO). Most of these problems will be specific to a particular design or project and are the responsibility of the project, not the Materials and Radiation Effects Branch. Consequently, the Task Group on Special Purpose Materials has limited its concern to crucial and generic materials problems that must be resolved if magnetic-fusion devices are to succeed. Important areas specifically excluded include low-field (8-T) superconductors, fuels for hybrids, and materials for inertial-confinement devices. These areas may be added in the future when funding permits.

58965 (DOE/ER/52076—2) **EPFL (Swiss) fusion-fission hybrid experiment. Progress report No. 2, February 1-April 30, 1982.** Woodruff, G.L.; Sitaraman, S. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 22 May 1982. Contract AT06-82ER52076. 24p. NTIS, PC A02/MF A01. Order Number DE82020265.

Portions of document are illegible.

Most of the activity during the current reporting period was related to Monte Carlo code development in order to accurately model the Haefely neutron source which will be used to drive the experiment. Continued liason was maintained with the staff of the Institut de Genie Atomique (IGA) of the Ecole Polytechnique Federale de Lausanne (EPFL) where the LOTUS Facility is located.

58966 (DOE/ET/51013—25) **Near-term tokamak-reactor designs with high-performance resistive magnets.** Cohn, D.R.; Bromberg, L.; Williams, J.E.C.; Becker, H.; Leclaire, R.; Yang, T. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Oct 1981. Contract AC02-78ET51013. 13p. (PFC/CP—81-2; CONF-811046—15). NTIS, PC A02/MF A01. Order Number DE82007365.

From Meeting and workshop on fusion reactor design and technology; Tokyo, Japan (5 Oct 1981).

Portions of document are illegible.

Advanced Fusion Test Reactors (AFTR) designs have been developed using BITTER type magnets which are capable of steady state operation. The goals of compact AFTR designs (with major radii R ~ 2.5 - 4 m), include DT ignition with large physics margins; high duty cycle, long pulse operation; and DD-DT operation with low tritium concentration. Larger AFTR designs (R ~ 5 m), have the additional goal of early demonstration of self sufficiency in tritium production. The AFTR devices could also serve as prototypes for commercial reactors. Compact ignition test reactors have also been designed (R ~ 1 - 2 m). These designs use BITTER magnets that are inertially cooled starting at liquid nitrogen temperature. A detailed engineering design was developed for ZEPHYR.

58967 (ECN—110) **Belt-shaped screw-pinch reactor.** Bustraan, M.; Klippel, H.Th.; Veringa, H.J.; Verschuur, K.A.; Brandt, B.; Hoekzema, J.A.; Schuurman, W.; Damstra, G.C.; Lievense, K. (Netherlands Energy Research Foundation, Petten). Dec 1981. 70p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702262.

The belt-shaped screw pinch is a pulsed toroidal plasma with an elongated cross-section. Force-free currents in an outer plasma envelope of low density allow beta to rise to high values in the order of 50%. This is a potential possibility to develop an economically attractive reactor. The physical requirements of its realization are described: formation, heating and ignition of a very small amount of the fuel to be burnt in one pulse by the fields generated by normal or superconducting coils. Then follows injection of the greater part of the fuel by D-T pellets and consequent plasma heating and expansion by nuclear reactions without undue disturbing of the plasma current configuration. Technical requirements include an insulating first wall and fast rising magnetic fields produced by superconducting coils. This reactor system is compared with the tokamak and the reversed-field pinch system.

58968 (EPRI-AP—2489) **Evaluation of magnetic-confinement-fusion engineering opportunities on existing and planned facilities. Final report.** DeFreece, D.A. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). Jul 1982. 197p. NTIS, PC A09/MF A01. Order Number DE82905816.

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This report addresses the identification of the critical engineering data needs for the commercialization of magnetic confinement fusion (MCF). The project assessed these for twenty-four MCF reactor designs. This resulted in the identification of seventy-eight critical engineering data requirements. These were weighted and ranked to arrive at a workable number of potential experimental areas that would contribute to the needed data base. These were presented to a workshop of MCF reactor concept advocates, technologists, experimentalists and test facility managers for evaluation. They recommended a set of specific experiments to resolve the identified needs. Using the criteria of high benefit-to-cost, timeliness, and appropriateness for EPRI sponsorship, the list of workshop-recommended experiments was narrowed to a selected set of twenty. These were further explored to enable a selection of ten experiments for consideration of sponsorship by EPRI. The selected experiments were then examined in more detail regarding the justification for the experiment, preliminary experiment definition, expected results, schedule and milestones and the approximate experiment cost. These ten experiment plans are discussed.

58969 (EPRI-AP—2515) **Ceramic materials for fusion reactors. Final report.** Trantina, G.C.; Corelli, J. (General Electric Co., Schenectady, NY (USA); Rensselaer Polytechnic Inst., Troy, NY (USA)). Jul 1982. 85p. NTIS, PC A05/MF A01. Order Number DE82905812.

Siliconized silicon carbide was identified as the most promising low-activity ceramic for use in fusion first walls and blankets. Further design and materials studies indicated that a cylindrical ceramic module attached to a low-activity aluminum backing plate can be designed with a very low probability of failure at a wall loading of 1 MW/m^2, assuming no degradation of the mechanical and physical properties of the ceramic. To achieve the low probability of failure, strengthening and proof testing of the ceramic by a heat treatment at 1200°C are necessary. Irradiation testing of silicon carbide concentrated on B^{10} doped specimens to study the effect of helium production during irradiation. Previous indications of a rapid decline in strength of boron-doped sintered alpha silicon carbide were confirmed. The strength of siliconized silicon carbide also decreases with increasing helium generation, but at a relatively slow rate. A strength decline of 24% was noted after irradiation to a fluence of 7.6×10^{24} n/m^2, during which 1280 AppM helium was produced. More refined and longer duration irradiation experiments are needed to determine if this decline in strength is likely to occur under actual fusion reactor operating conditions.

58970 (EUR—6584(Vol.1), pp 421-423) **Introduction of impurities due to plasma-wall interaction.** Behrisch, R. (EURATOM-IPP Association, Garching, Germany, F.R.). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

58971 (EUR—6584(Vol.1), pp 425-447) **Plasma-wall interaction and the processes determining the hydrogen particle balance.** Behrisch, R. (EURATOM-IPP Association, Germany, F.R.). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

For a hot plasma as investigated in fusion research, the magnetic confinement is not perfect. The particles leak out through the magnetic surfaces and hit the surrounding solid walls. They are partly recycled from the wall by backscattering and release of gas atoms previously implanted and trapped in the wall material. As there is no thermal equilibrium between the plasma and the solid, the Plasma Wall Interaction has to be understood in terms of the various atomic processes taking place at the first wall. The processes influencing the hydrogen particle balance have only recently been investigated in laboratory experiments. While particle backscattering is reasonably understood, the processes of trapping, diffusion and release of the gas atoms from the solid are more difficult to describe, because they depend on many parameters including the history of the solid wall and its temperature.

58972 (EUR—6584(Vol.1), pp 449-452) **Particles refuelling.** Duechs, D. (EURATOM-IPP Association, Garching, Germany, F.R.). 1979. NTIS (US Sales Only), PC A21/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

58973 (EUR—6584(Vol.2), pp 503-533) **Operational characteristics of intermediate and low field tokamaks.** Hawryluk, R.J. (Princeton University, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The results from intermediate and low field devices will be described with particular attention to the way these results apply to future devices. In particular, developments in impurity control and plasma handling techniques in ohmically heated discharges are reviewed. These developments have been important in optimizing the performance of tokamak devices.

58974 (EUR—6584(Vol.2), pp 535-555) **Neutral beam injection experiments.** Goldston, R.J. (Princeton Univ., USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

In this lecture we will review experimental aspects of neutral beam heating on tokamaks. We will begin by assessing recent progress in high-current, high-voltage neutral beam technology. We will then briefly look at the problems of beam penetration into large dense reactor-grade plasmas. After this we will examine the experimental data available on the physics of beam ion thermalization, and finally we will review the results from recent neutral beam injection experiments.

58975 (EUR—6584(Vol.2), pp 557-570) **Regimes of operation in the Princeton Large Torus.** Hosea, J. (Princeton Univ., USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

In the quest for optimum discharge conditions in the Princeton Large Torus (PLT), a variety of discharge regimes have been produced. These separate broadly into two main categories - those regimes with $m >= 2$ oscillatory MHD instabilities and often hollow electron profiles for tungsten limiters, and those regimes for which the electron temperature is sufficiently peaked to support the internal sawtooth or near-sawtooth ($m = 1$) instability. The internal sawtooth regime is found to be optimum for confinement but to be more difficult to select when low-Z impurity concentrations have been reduced with low power discharge cleaning or gettering to permit extension of the high density operation limit. Gas programming is used to cool the plasma periphery, thereby reducing the high-Z impurity concentrations and causing the current channel to constrict into the sawtooth regime, and then to attain the desired plasma density. With dicharges selected in this manner, gross energetic confinement times up to approximately 100 msec have been obtained at densities of approximately 10^{14} cm^{-3}, and very high ion and electron temperatures have been produced with neutral beam injection heating at lower densities with no observable deleterious effect on energy confinement.

58976 (EUR—6584(Vol.2), pp 633-658) **Tandem mirror and field-reversed mirror experiments.** Coensgen, F.H.; Simonen, T.C.; Turner, W.C. (University of California, Livermore, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Multiple-mirror systems offer significant enhancement of the power balance above that attainable from a conventional single-cell mirror reactor. Several multiple-mirror configurations are under experimental investigation: the tandem mirror, the high-density multiple-mirror, and the field-reversed mirror. This paper is largely devoted to tandem mirror and field-reversed mirror experiments at the Lawrence Livermore Laboratory (LLL), and briefly summarizes results of experiments in which field-reversal has been achieved. In the tandem experiment, high-energy, high-density plasma (nearly identical to 2XIIB plasmas) are located at each end of a solenoid where plasma ions are electrostatically confined by the high positive potentials arising in the "end plug" plasmas. End plug ions are magnetically confined, and electrons are electrostatically confined by the overall positive potential of the system. The field-reversed mirror reactor consists of several small field-reversed mirror plasma linked together for economic reasons. In the LLL Beta II experiment, generation of a field-reversed plasma ring will be investigated using a high-energy plasma gun with a transverse radial magnetic field. This plasma will be further heated and sustained by injection of intense, high-energy neutral beams.

58977 (EUR—6584(Vol.2), pp 687-724) **Burn phase and structural problems of compact fusion experiments.** Coppi, B. (Massachusetts Institute of Technology, USA); Taroni, A. (CNEN, Bologna, Italy). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

The present paper is organized as follows: in Section II we give the reference parameters of an experiment of the Ignitor type, and give the main justification for their choice. In Section III we describe the transport model on the basis of which the heating cycles for this kind of experiment can be predicted. In Section IV we describe the structural analysis that we have carried out for the main magnet systems of the device and the numerical codes that we have developed and used for this analysis. In Section V we indicate the advantages that could be realized by adopting composite materials for the main magnet structures. In Section VI we discuss the foreseeable applications of an Ignitor type of device and indicate how it may be possible to employ one for experiments to demonstrate net power production.

58978 (EUR—6584(Vol.2), pp 725-748) **Tokamaks TFTR, JT60 and JET.** Bickerton, R.J. (JET Joint Undertaking, Abingdon, England). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Three large tokamaks in the several megampere discharge current range are at present under construction. They are JET (Europe), TFTR (USA), and JT60 (Japan). The parameters of these three machines have been chosen with different scientific objectives in mind; these will be outlined and compared. The performance to be expected in these machines in the light of our best present knowledge will be discussed. The information to be expected from these machines on the key issues of containment, impurities, plasma beta and alpha-particle effects will be outlined. Finally, we relate this to the requirements of the on-going programme in particular to the design and construction of the next generation, the tritium burners.

58979 (EUR—6584(Vol.2), pp 779-794) **Alternate concepts and new experiments in existing devices for the investigation of thermonuclear regimes.** Clarke, J.F. (Office of Fusion Energy, Washington, D.C., USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Fusion reactors can ignite with a range of electron and ion temperatures and energy confinement times. The characteristics of ignited reactors will depend on these factors as well as the fuel used. Hot ion mode operation, which is the natural ignited state of a tokamak, leads to enhanced possibilities for utilization of the deuterium-deuterium fuel cycle and achievement of an attractive reactor. These reactors give new scope for application of modern plasma physics.

58980 (EUR—6584(Vol.2), pp 795-803) **Alternate concepts for magnetic fusion.** Nelson, D.B. (Office of Fusion Energy, Washington, USA). 1979. NTIS (US Sales Only), PC A18/MF A01.

From International school of plasma physics course and workshop; Varenna, Italy (28 Aug 1979).

Concepts for magnetic confinement are reviewed for desirability as fusion reactors. Physics and technology advantages, uncertainties, and problems are discussed. Alternate fuel cycles, including D-D, D-He^3, and p-Li^6, are considered for possible advantages over D-T. Concepts currently under investigation which offer potential improvement over tokamaks include tandem mirrors, Elmo Bumpy Torus, compact tori encompassing reversed field mirrors, reversed field theta pinches and spheromak, stellarators, multipoles, and reversed field Z pinches.

58981 **(EUR-CEA-FC—1106) Theoretical study of the attenuation of a gaussian beam penetrating into a dielectric circular wave guide.** Crenn, J.P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jul 1981. 45p. (In French). NTIS (US Sales Only), PC A03/MF A01.

It is proposed to draw up an approximate formula directly giving the attenuation of a gaussian beam penetrating into a superdimensioned dielectric circular wave guide. This formula is derived from optical laws, i.e. Fresnel's formulae of the reflexion of a wave on a dielectric to which a correcting term due to diffraction has been added. The results given by this formula are compared with the existing results, based on the breakdown of a gaussian beam into propagation modes, thereby enabling their validity and the field of use to be checked. An application is then made to the wave guides that will be employed in the infrared interferometer fitted in JET.

58982 **(EUR-CEA-FC—1115) Antennas of ion cyclotron heating installed in the TFR Tokamak. General characteristics, and coupling properties.** (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee). Sep 1981. 56p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82701975.

We describe and discuss the properties of two kinds of antenna installed in the TFR Tokamak. The first type of antenna is an array of 8 narrow radiating elements which could transfer 2 MW to the plasma. The second type is made of two much wider radiating elements located on the low field side of the Tokamak. Particular emphasis is given to the measurements of the coupling properties as a function of magnetic field, density, gas composition, frequency and distance between the antenna and the plasma. Both toroidal and radial eigen mode are clearly observed. They appear as a fast toroidal modes or slow radial modes variation of the loading resistance when the plasma density changes. Theses fluctuations disappear when a strong damping mechanism is established: hydrogen-deuterium hybrid resonance or second harmonic hydrogen resonance. The conditions of appearance of radial eigen-modes are found to agree precisely with the magnetosomic wave resonance. Current theory also correctly predicts the variation of the loading resistance with the distance between the antenna and the plasma. A rapid increase of the loading resistance with frequency is observed. The effect could not be related to the predictions of coupling theories.

58983 **(ILE—7902P) Self-generated magnetic field in CO_2 laser produced plasma.** Kitagawa, Y.; Thein, A.; Yamada, Y.; Yokoyama, M.; Yamanaka, C. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 23 Jul 1979. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702499.

Measurements have been made of an azimuthal magnetic field spontaneously associated with plasmas produced by the irradiation of an 80 ns CO_2 laser pulse to a CD_2 target. The magnetic field diffuses from an initial source into an ambient nitrogen plasma. Extrapolation of measured data to the initial target surface shows a field intensity of ~0.6 MG. The diffusion coefficient calculated from the ambient plasma parameters is in accordance with direct experimental data. The diffused field is followed by the expanding laser target plasma. For sufficiently high ambient gas pressure, the field direction is reversed.

58984 **(ILE—7907P) Computer simulation of nonlinear propagation characteristics of CO_2 laser pulse.** Daido, H.; Okehara, J.; Ido, S.; Matobe, M.; Nakai, S. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 19 Oct 1979. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702500.

The characteristics of a pulse propagation through the CO_2 laser system LEKKO PI are analysed numerically using MELCOM COSMO 700 PI digital computer. The amplifiers are treated as Frantz and Nodvik type rate equation model and the SF_6 saturable absorbers are treated as phenomenological model based on the measurement of energy transmission. The computed results are compared with the observed data of the pulse energy, the rise time of pulse and the pulse duration (FWHM). It is found that the pulse peak delays in case of relatively small incident pulse energy due to the nonlinear absorption characteristics of SF_6 and it proceed effectively in case of relatively large incident pulse energy due to the nonlinear amplification characteristics of CO_2 lasers. The multi-line amplification code is developed. The effect of the double band and the multi-line energy extraction and the ratio of the pulse energy in individual rotational line to whole pulse energy after passing through the laser amplifier are discussed.

58985 **(ILE—7914P) Recent thin foil target experiments on Reiden III.** Imasaki, K.; Miyamoto, S.; Higaki, S.; Ozaki, T.; Nakai, S. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 7 Feb 1980. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702501.

The dynamic behaviors of a blow-off plasma of a thin layered target were observed optically by shadowgraphy and interferometry. The results were explained by using ablative and explosive models. Experimental evidence of highly efficient beam coupling which induces hydrodynamic drive of plasma is presented.

58986 **(ILE—8002P) Computational study on light ion beam fusion.** Ido, S.; Higaki, S.; Yabe, T.; Imasaki, K.; Nakai, S. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 16 Feb 1980. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702502.

One dimensional computational study on pellet implosion, ignition and burn by light ion beam is presented. The effects of thickness of Au shell or tamper and fuel mass are investigated and breakeven condition is examined for 100TW, 10MeV, 2MJ proton beam.

58987 **(ILE—8004P) Effects of thermal conduction and compressibility on Rayleigh-Taylor instability.** Takabe, H.; Mima, K. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 28 Feb 1980. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702503.

In order to study the stability of the ablation front in laser driven implosion, the thermal conduction and compressibility effects on the Rayleigh-Taylor instability are considered. It is found that the thermal conduction effect cannot stabilize the Rayleigh-Taylor mode, but reduce the growth rate in the short wavelength case. But, the growth rate is found not to differ from the classical value $\sqrt{gk}$ in the long wavelength limit, where the compressibility is essential.

58988 **(ILE—8005P) Ion beam generation on Reiden III.** Miyamoto, S.; Imasaki, K.; Higaki, S.; Ozaki, T.; Nakai, S. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 8 Mar 1980. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702504.

A high power pulse generator Reiden III has been used to produce light ion beams. Currents in excess of 2 kA with current density greater than 50 A/cm^2 have been produced in a 100 ns bursts at energy 200 keV using a pinched REB diode. Experiments of magnetic insulation ion diode were begun for generation of protons.

58989 **(ILE—8012P) Investigation of implosion symmetry and stability by time-resolved x-ray shadowgraphy.** Mochizuki, T.; Yabe, T.; Azechi, H.; Okada, K.; Yamanaka, C. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 17 Jul 1980. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702506.

A strong dependence of implosion symmetry on laser focusing conditions and a growth of a whisker-like irregularity on ablation surface were observed in ablatively compressed laser fusion pellets by using time-resolved x-ray shadowgraphy. The time development of the implosion nonuniformity was traced by a 2-D fluid PIC code. The simulation result supports a hydrodynamic "free-falling" effect on the growing irregularity, which explains well the experimental results quantitatively within a factor of 2.

58990 **(ILE—8016P) Neutronics in pellets of inertial confinement fusion.** Ido, S.; Hattori, K.; Kodaira, H.; Kondo, S.; Nakai, S. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 10 Dec 1980. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702508.

One dimensional neutron transport calculations were carried out for high density DT pellets by ANISN-JR code and the nuclear data GICX-40. When rhoR becomes larger than 1 g/cm^2, neutron spectrum is evidently softened and the limitation on the design of ICF reactors is relaxed. Softened neutron spectra from bare DT targets with rhoR = 0.7, 3.0 and 6.0 g/cm^2 are presented. Neutron spectra from DT targets of rhoR = 3.0 g/cm^2 with a Pb tamper, a CH_2 foam and a Pb pusher are also presented. A Pb tamper and a Pb pusher multiply neutrons from a pellet. A CH_2 foam sufficiently moderates energetic neutrons.

58991 **(ILE—8018P) Studies on implosion efficiency in LIB driven implosion.** Higaki, S.; Imasaki, K.; Ido, S.; Nakai, S.; Yamanaka, C. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). 10 Dec 1980. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702509.

One dimensional computational studies on implosion efficiency in LIB driven implosion is presented. The highest implosion efficiency of 0.17 can be obtained by 10 MeV proton beam.

58992 **(IPPJ—502) Simulation for implosion of hollow shell target bombarded by proton beam.** Kawata, S.; Niu, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701982.

A newly developed one-dimensional hydrodynamic code "Mt. FUJI" is used to simulate the implosion motion of a hollow shell target. The code includes special processes occurring in the target such as fuel depletion caused by fusion reactions and reabsorption of neutrons, α-particles and photons which are produced in the target, as well as the ordinary processes, for instance, depositions of energy, momentum and mass of impinging light ion beams. The simulation shows that a pellet gain of more than 90 can be attainable in an adiabatic compression of the fuel provided that the pellet has the optimum amount of D-T fuel and the fuel velocity exceeds 10^7 cm/sec at the pellet implosion.

58993 **(IPPJ—503) Overview of neutral beam injector technology developments at universities.** Miyahara, A. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701983.

Activities of universities on the neutral beam injector developments have been overviewed. The subjects consist of NBI construction, components developments and system analyses, which are intensively studied at universities. Although neutral beam injector technologies are present day top topics, however, still a lot of efforts with flexible ideas are necessary to realize reactor relevant neutral beam injector system.

58994 **(IPPJ—508) Deflagration wave with radiative energy transport.** Tamba, M.; Niu, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701985.

Numerical calculations are carried out to analyze spatial structures of stationary deflagration waves formed in slab targets. In the analysis, radiative energy transport is taken into account. Profiles of radiative energy flux differ depending on the states of the outer-layer material of the target (solid or plasma). However radiative energy transport plays a negligible role in deflagration-wave structures formed by light-ion beam.

58995 **(IPPJ—518) Ablation acceleration of macroparticle in spiral magnetic fields.** Ikuta, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). May 1981. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702510.

The rocket motion of macroparticles heated by energetic pulses in a spiral magnetic field was studied. The purpose of the present work is to study the ablation acceleration of a macroparticle in a spiral magnetic field with the help of the law of conservation of angular momentum. The basic equation of motion of ablatively accelerated projectile in a spiral magnetic field was derived. Any rocket which is ejecting fully ionized plasma in an intense magnetic field with rotational transform is able to have spin by the law of conservation of momentum. The effect of spiral magnetic field on macroparticle acceleration is discussed. The necessary mass ratio increase exponentially with respect to the field parameter. The spiral field should be employed with care to have only to stabilize the position of macroparticles. As conclusion, it can be said that the ablation acceleration of the projectile in a spiral field can give the accelerated body spin quite easily.

58996 **(IPPJ—524) Observation of lower hybrid current drive in the JIPP T-II torus.** Ohkubo, K.; Takamura, S.; Kawahata, K.; Tetsuka, T.; Matsuura, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1981. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702263.

A toroidal current driven by the lower hybrid wave has been observed in low density plasmas in the JIPP T-II. It is confirmed that rf-driven current is generated by momentum transfer of the lower hybrid waves to suprathermal electrons with the energy of 8 - 25 keV. The driving efficiencies in tokamak and stellarator configurations are 1 kA/kW and 0.3 kA/kW at the power level of 40 kW, respectively. Electron cyclotron emission measured by changing the receiving frequency indicates that the current profile driven by rf is hollow. Enhanced electron cyclotron emission due to the pitch-angle scattering of rf-driven runaway electrons is observed, and spikes in loop voltage and X-ray bursts appear coincidentally. In a long rf pulse, these rapid changes advance to relaxation oscillations. It is concluded that the pulsating changes originate in the instantaneous scattering of rf-driven runaway electrons by the unstable waves excited at an anomalous Doppler resonance.

58997 **(IPPJ—525) Magnetic configuration of twin tori for a new bundle divertor.** Ikuta, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1981. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701992.

The system of twin tori is numerically studied in detail in order to have diverted flux surface without intersecting chamber wall. The key parameters of practical twin tori are found to be both the number and the shape of the toroidal field coils. Typical examples of coil system are also shown.

58998 **(IPPJ—526) Field reversal by rotating waves.** Fisch, N.J.; Watanabe, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701993.

Rotating waves have been suggested as a means of generating currents that, in turn, can produce a compact torus configuration. The practicality of this scheme is assessed with regard to stability and power requirements. The method of generating current is compared to other methods of non-Ohmic current-drive.

58999 **(IPPJ—541) Plasma focus breeder.** Ikuta, K. (Nagoya Univ. (Japan)). Sep 1981. 15p. NTIS, PC A02/MF A01.

High voltage generation on pinched plasma by a plasma focus device was investigated. Fissile fuels are bred with the help of high current plasma focus device. A mechanism of accelerating proton beam in plasma focus device to high energy changes the inductance in plasma column because of rapid growth of plasma instability. It is concluded that a high current plasma focus device is a good candidate for the generation of energetic, intense proton beams which can be utilized for breeding fissile fuels.

59000 **(IPPJ—542) Feedback plasma control in hybrid poloidal coil system.** Hamada, Y.; Abe, Y.; Kitagawa, S.; Toi, K. (Nagoya Univ. (Japan)). Sep 1981. 25p. NTIS, PC A02/MF A01.

Analysis of feedback control characteristics in the hybrid poloidal coil system (hybrid of the ohmic and the equilibrium vertical coils) is performed. It is found that, in the complex hybrid poloidal coil system, the plasma can be sufficiently well controlled using very simple equations for the calculation of feedback voltage.

59001 **(IPPJ-DT—84) Design and construction of a horizontally placed superconducting magnet and its cryostat for an electron beam ion source.** Kobayashi, N.; Ohtani, S.; Kaneko, Y.; Iwai, T.; Okuno, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1981. 36p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701995.

An electron beam ion source nicknamed NICE-I (Naked Ion Collision Experiments) has been constructed at IPP for studies of atomic processes in fusion plasmas. A super conducting magnet is adopted to generate a strong, stable and homogenious magnetic field to compress a high density electron beam. The solenoid is 1 m long, the inner diameter is 100 mm and the maximum magnetic field is 2T. It is placed horizontally and coaxially with a liquid nitrogen (L-N$_2$) reservoir and a vaccum vessel. In order to fix their axes inmovable even when the reservoirs are cooled by L-N$_2$ and He, a structure having spokes strained uniformly like a wheel is used between the vaccum vessel and the L-N$_2$ reservoir and also between the L-N$_2$ reservoir and the solenoid bore. The electrodes, such as the electron gun, the drift tubes and so on, are mounted on the radiation shields fixed on the L-N$_2$ reservoir, and they are centered to the solenoid bore within the precision of 0.1 mm. The evapolation rate of L-He is about 1.4 l/h, which is not so much larger than the estimated value. This provides a continuous operation for 16 hours with a charge of 50 l L-He including the precooling of the reservoir. The ultimate pressure 4×10^{-10} Torr is achived in the vacuum vessel, and the residual gas pressure in the ionization region is expected to be much lower than 1×10^{-10} Torr. The consideration for mechanical strength and the heat conduction of the materials related to the design are described as well as the details of the structure.

59002 **(IPPJ-T—33) Test stand for magnetron H$^-$ ion source at IPP-Nagoya.** Okamura, H.; Kuroda, T.; Miyahara, A. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701996.

The test facilities for the development of magnetron H$^-$ ion source are described putting stress upon their electronics.

59003 **(JAERI-M—9443) Indirectly heated cathode for the ion source of neutral beam injector.** Tanaka, S.; Arakawa, Y. (Japan Atomic Energy Research Inst., Tokyo). Apr 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701997.

An indirectly heated cathode made of impregnated porous tungsten emitter was prepared for the ion source of neutral beam injector. The cathode was applied to a duoPIGatron hydrogen ion source, where discharge characteristics and the cathode life time were tested. Beam extraction from the source was also carried out. The accumulated discharge time of the cathode was over 20 hours which corresponds to a life time of 2 months for normal use, and the cathode was still usable after the test.

59004 **(JAERI-M—9470) Helium compression and enrichment with poloidal divertor. Doublet-III experimental report, 7.** Shimada, M.; Nagami, M.; Ioki, K. (Japan Atomic Energy Research Inst., Tokyo). Apr 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701999.

The helium ash enrichment function of a divertor has been experimentally demonstrated. Helium atoms accumulate in the divertor region, as the electron density of main plasma increases. With a helium allowance of 1% of electron density in the main plasma, neutral helium at the divertor region is as high as 3.6×10^{-5} Torr. A factor of 2.4 helium enrichment in the divertor region was also observed. This experiment indicates the possibility of helium ash exhaust in an alpha-heated, diverted tokamak using practical-sized pumping ducts.

59005 **(JAERI-M—9517) Charge accumulation in insulators of poloical field coils due to x-ray irradiation.** Tanaka, R.; Sunaga, H.; Tamura, N.; Ando, T.; Ieda, M.; Kadotani, K. (Japan Atomic Energy Research Inst., Tokyo). Jun 1981. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702000.

The behavior of excess charge accumulation in the insulators of the poloidal field coils of the JT-60 (critical plasma facility) when exposed to hard X-rays produced on runaway discharge was estimated mainly by calculations. The continuity and Poisson's simultaneous equations concerning the excess charge were solved based on estimating the distributions of absorbed dose rate and excess charge deposition rate in the insulator (epoxy resin) under the irradiating condition assumed in the JT-60 and on measured radiation induced conductivity in the insulator under and after irradiation. Under the most severe irradiating condition, calculated values of electric field strength at the surface of the insulator exceeds 5 MV/cm after about 20th ranaway discharge (duration time : 5 sec per on discharge), and the saturation value exceeds 10 MV/cm. Since the delayed conductivity is very small, the charge leakage for the time interval between discharges influences the saturated value very little. We consider that local dielectric breakdowns may occur near the surface of the insulator, but it dose not propagate into deeper region owing to the non-uniform field. The relation between X-ray induced current under irradiation and inner electric field was also examined.

59006 **(JAERI-M—9539) Thermal stress analysis on the extraction grid. Exit grid for JT-60 NBI.** Shibanuma, K.; Kuriyama, M.; Ohara, Y.; Okumura, Y. (Japan Atomic Energy Research Inst., Tokyo). Jun 1981. 25p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82702001.

The ion sources of the neutral beam injectors for JT-60 are required to produce stable ion beam of 50 -- 100 keV, 35 -- 40 A for a long pulse length of up to 10 sec. This long pulse operation at high power level causes several difficult problems. One of the problems is the thermal stress in the extraction grids. In this report, a thermal stress analysis method using finit element method has been applied to the exit grid, which is subjected to a relatively large and one-side heat loading. Oxygen-free copper and molybdenum are considered as caudidate materials of the grid for this numerical analysis. Results are evaluated according to the ASME-Sec.III Code. The stress in copper grid is extremely larger than the allowable value all over the multi-aperture region. Therefore, the design of copper grid must be fundamentally reconsidered. On the other hand, the stress in molybdenum grid is shightly over the allowable value only at two corners of the multi-aperture region. A small structural improvement in this grid enables us to suppress the stress below the allowable value.

59007 **(JAERI-M—9577) Physical design considerations of the next tokamak fusion reactor. Parameter survey of the device size.** Fujisawa, N.; Sugihara, M. (Japan Atomic Energy Research Inst., Tokyo). Jul 1981. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702002.

Wide range of parameter surveys on the next device to JT-60 are made. Various physical and engineering requirements are taken into account, e.g., self-ignition, available maximum beta value, total fusion power, neutron wall loading, α-particle confinement, heat flux to divertor plate, structural restriction on aspect ratio, device size, maximum toroidal magnetic field and so on. Since the energy confinement scaling law has ambiguities, emphases are placed on the methodology to determine the plasma and device parameters realizing the various objectives of the next device.

59008 **(KFTI—81-44) Magnetic field components of helical conductors with a current on a torus.** Kalyuzhnyj, V.N.; Nemov, V.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 31p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702512.

Using the Biot-Savart low the formulae for components of a vacuum magnetic field, generated by a current of helical conductors located on a torus surface at an arbitrary winding pitch with regard to possible modulation of the winding angle, are obtained. The expressions obtained having the form of power series expansions of the distance from the circular torus axis can be used in analytical studies of magnetic configurations of stellarator-type traps.

59009 (KFTI—81-45) **Main physical problems of "Uragan-3" device.** Volkov, E.D.; Georgievskij, A.V.; Dikij, A.G.; Loginov, A.S.; Suprunenko, V.A.; Tolok, V.T.; Shvets, O.M.; Yuferov, V.B. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702007.

The present state of investigations on plasma thermal insulation, confinement and equilibrium in stellarators is analyzed. The ways for further development of studies are outlined. The main parameters and description of the design of a new fusion installation - the "Uragan-3" torsatron with a divertor are presented. The program of investigations on the installation is discussed.

59010 (LA—9383-MS) **Tritium-gas/water-vapor monitor. Tests and evaluation.** Jalbert, R.A. (Los Alamos National Lab., NM (USA)). Jul 1982. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01. Order Number DE82019706.

A tritium gas/water-vapor monitor was designed and built by the Health Physics Group at the Los Alamos National Laboratory. In its prototype configuration, the monitor took the shape of two separate instruments: a (total) tritium monitor and a water-vapor monitor. Both instruments were tested and evaluated. The tests of the (total) tritium monitor, basically an improved version of the standard flow-through ion-chamber instrument, are briefly reported here and more completely elsewhere. The tests of the water-vapor monitor indicated that the novel approach used to condense water vapor for scintillation counting has a number of serious drawbacks and that further development of the instrument is unwarranted.

59011 (LA-UR—82-1192) **US program in heavy-ion fusion.** Bangerter, R.O. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 17p. (CONF-820338—8). NTIS, PC A02/MF A01. Order Number DE82015769.

From Symposium on accelerator aspects of ion fusion; Darmstadt, F.R. Germany (29 Mar 1982).

Portions of document are illegible.

A national plan for heavy ion fusion research is outlined. The transfer of the heavy ion fusion program from the Defense Programs to the Office of Energy Research is discussed. (MOW)

59012 (LA-UR—82-1973) **Identification of future engineering-development needs of alternative concepts for magnetic-fusion energy.** Krakowski, R.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 39p. (CONF-820838—1). NTIS, PC A03/MF A01. Order Number DE82019566.

From Future engineering development needs for magnetic fusion workshop; Washington, DC, USA (3 Aug 1982).

A qualitative identification of future engineering needs of alternative fusion concepts (AFCs) is presented. These needs are assessed relative to the similar needs of the tokamak in order to emphasize differences in required technology with respect to the well documented mainline approach. Although nearly thirty AFCs can be identified as being associated with some level of reactor projection, redirection, refocusing, and general similarities can be used to generate a reduced AFC list that includes only the bumpy tori, stellarators, reversed-field pinches, and compact toroids. Furthermore, each AFC has the potential of operating as a conventional (low power density, superconducting magnets) or a compact, high-power-density (HPD) system. Hence, in order to make tractable an otherwise difficult task, the future engineering needs for the AFCs are addressed here for conventional versus compact approaches, with the latter being treated as a generic class and the former being composed of bumpy tori, stellarators, reversed-field pinches, and compact toroids.

59013 (LA-UR—82-2148) **Compact reversed-field pinch reactor (CRFPR): a high-density approach to magnetic fusion energy.** Hagenson, R.L.; Krakowski, R.A.; Byrne, R.N.; Dobrott, D. (Los Alamos National Lab., NM (USA); Technology International, Inc., Ames, IA (USA); Science Applications, Inc., La Jolla, CA (USA)). 1982. Contract W-7405-ENG-36. 12p. (CONF-820930—1). NTIS, PC A02/MF A01. Order Number DE82018106.

From 9. international conference on plasma physics and controlled nulcear fusion research; Baltimore, MD, USA (1 Sep 1982).

Because of the unique magnetic topology associated with the Reversed-Field Pinch (RFP), the compact reactor embodiment for this approach is particularly attractive from the viewpoint of low-field resistive coils operating with Ohmic losses that can be made small relative to the fusion power. The cost-optimized Compact RFP Reactor (CRFPR) design would operate with fusion-power-core power densities and mass utilizations that are comparable to fission power plants and are an order of magnitude more favorable than the conventional fusion approaches. A comprehensive system model predicts the CRFPR point design to be surprisingly resilient to changes in key, but relatively unknown, physics and systems parameters.

59014 (NASA-CR—168848) **Proceedings of the second international colloquium on drops and bubbles.** Lecroissette, D.H. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1982. 400p. (JPL-PUB—82-7; CONF-811174—). NTIS, PC A17/MF A01.

From 2. convention of the international colloquium on drops and bubbles; Monterey, CA, USA (19 Nov 1981).

Applications of bubble and drop technologies are discussed and include: low gravity manufacturing, containerless melts, microballoon fabrication, ink printers, laser fusion targets, generation of organic glass and metal shells, and space processing. The fluid dynamics of bubbles and drops were examined. Thermomigration, capillary flow, and interfacial tension are discussed. Techniques for drop control are presented and include drop size control and drop shape control. For individual titles, see N82-23419 through N82-23469.

59015 (NASA-CR—168848, pp 1-6) **Drops and bubble in materials science.** Doremus, R.H. Mar 1982. NTIS, PC A17/MF A01.

From 2. convention of the international colloquium on drops and bubbles; Monterey, CA, USA (19 Nov 1981).

The formation of extended p-n junctions in semiconductors by drop migration, mechanisms and morphologies of migrating drops and bubbles in solids and nucleation and corrections to the Volmer-Weber equations are discussed. Bubble shrinkage in the processing of glass, the formation of glass microshells as laser-fusion targets, and radiation-induced voids in nuclear reactors were examined.

59016 (NASA-CR—168848, pp 96-106) **Behavior of liquid hydrogen inside an ICF target.** Kim, K.; Mok, L.; Bernat, T. Mar 1982. NTIS, PC A17/MF A01.

From 2. convention of the international colloquium on drops and bubbles; Monterey, CA, USA (19 Nov 1981).

The configuration of liquid hydrogen inside spherical glass shell ICF target was studied both theoretically and experimentally. Because of the zero contact angle between the .D2 liquid and glass substrate and the limited wetting surface that is continuous, the liquid hydrogen completely covers the interior of the glass shell, resulting in the formation of a void at the center. For this reason, the present problem distinguishes itself from that for a sessile drop sitting on a flat surface. A theory was formulated to calculate the liquid hydrogen configuration by including the London-dispersion force between the liquid and the substrate molecules. The net result is an augmented Bashforth-Adams equation appropriate to a spherical substrate, which is considered to be the major contribution of the present work. Preliminary calculations indicate that this equation accurately models the liquid hydrogen behavior inside a spherical microshell.

59017 (NASA-CR—168848, pp 107-111) **Generation of a strong core centering force in a submillimeter compound droplet system.** Lee, M.C.; Feng, I.A.; Elleman, D.D.; Wang, T.G.; Young, A.T. (LASL). Mar 1982. NTIS, PC A17/MF A01.

From 2. convention of the international colloquium on drops and bubbles; Monterey, CA, USA (19 Nov 1981).

By amplitude-modulating the driving voltage of an acoustic levitating apparatus, a strong core centering force was generated in a submillimeter compound droplet system suspended by the radiation pressure in a gaseous medium. Depending on the acoustic characteristics of the droplet system, it was found that the technique can be utilized advantageously in the multiple-layer coating of an inertial confinement fusion pellet.

59018 (ORNL/Sub—79/21453/7) **60 GHz gyrotron development program. Quarterly report No. 7, January-March 1981.** Shively, J.F.; Evers, S.J.; Evans, S.J.; Stone, D.S. (Oak Ridge National Lab., TN (USA); Varian Associates, Palo Alto, CA (USA). Palo Alto Microwave Tube Div.). 1981. Contract W-7405-ENG-26. 45p. NTIS, PC A03/MF A01. Order Number DE82005760.

Portions of document are illegible.

The objective of this program is to develop a microwave oscillator capable of producing 200 kW of CW power at 60 GHz. The use of cyclotron resonance interaction is being pursued. The design, early construction, and test phases are discussed. A peak output power of over 200 kW was obtained with over 50% efficiency at pulse durations of 20 μs.

59019 (ORNL/Sub—79/21453/S1) **60-GHz gyrotron development program alternate frequency study.** Evans, S.J.; Nordquist, A.L.; Wendell, G.E. (Oak Ridge National Lab., TN (USA); Varian Associates, Palo Alto, CA (USA). Palo Alto Microwave Tube Div.). Aug 1981. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE82005761.

The purpose of this study was to take a preliminary look at what the considerations are when scaling the frequency of a gyrotron oscillator a few percent from an existing design. To minimize construction costs, it would be most advantageous to keep all parts the same and operate only with slightly different voltages and magnetic fields. There are two tube parts that must be changed for any frequency modification: the tube output window and the oscillation cavity. This study assumed that the output window and the cavity would be scaled in dimensions for best operation at the new frequency. The main thrust of the study was to examine the feasibility of using the 60 GHz gun (K-8060) and magnet (VYW-8060) for operation at 56 and 52 GHz, and the 28 GHz gun (K-8000) and magnet (VYW-8000) for operation at 26 and 30 GHz. All work was done using Varian computer gun codes and hand calculations. It must be mentioned that these results are only a guideline and that a final design would need some further fine tuning.

59020 (PPPL—1901) **Optimum shapes for pump limiters.** Ulrickson, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1982. Contract AC02-76CH03073. 23p. NTIS, PC A02/MF A01. Order Number DE82014978.

The design of a pump limiter depends strongly on the details of the plasma scrapeoff zone. A model has been developed which allows the transport coefficients in the scrapeoff to be functions of n and t. This model has been used to predict scrapeoff profiles for FED/INTOR. The profiles are used to find and analyze limiter profiles. The results suggest the use of limiter shapes which curve toward the plasma.

59021 (PPPL—1923) **Hyperbolic-secant mode coupling.** Doane, J.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1982. Contract AC02-76CH03073. 31p. NTIS, PC A03/MF A01. Order Number DE82020260.

This work presents a new solution of the coupled mode equations for a hyperbolic secant spatial variation of the coupling between two modes. An analytic expression is given for the transmission coefficient for arbitrary complex differential propagation constant and coupling strength. The expression is particularly simple in the case when the differential attenuation between the modes is negligible. Design curves are presented in terms of normalized parameters. The hyperbolic secant coupling may be truncated and still yield virtually the same transmission as for infinite coupling length. The required coupling length is indicated by a comparison of the ideal expression with the results of numerical integration of the coupled mode equations. Hyperbolic secant coupling can be particularly useful for the design of low-loss bends and twists in overmoded waveguide.

59022 (TRITA-PFU—82-02) **Temperature gradient effects on the neutral gas penetration into a magnetized plasma.** Bures, M. (Stockholm Univ. (Sweden). Fysiska Institutionen). Jan 1982. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702514.

The experimental evidence of temperature gradient effects on the neutral gas penetration into plasma is presented. It is found that an increased temperature gradient reduces the neutral gas content in the partially ionized boundary layer of a cold gas blanket system. A strong modification of the rotation plasma equilibrium is then observed. Such an equilibrium is a sensitive function of the neutral gas concentration both in the plasma in its boundary layers. The moderate values of the centrifugal force with act both on the ions and neutrals do not appreciably influence the plasma permeability to neutral gas. It is further observed that an acceleration of neutrals has to take in a rotating plasma.

59023 (UCRL—53263) **FORIG: a modification of the ORIGEN2 isotope-generation and depletion code for fusion problems.** Blink, J.A. (Lawrence Livermore National Lab., CA (USA)). 3 Mar 1982. Contract W-7405-ENG-48. 12p. NTIS (US Sales Only). Order Number DE82016133.

Portions of document are illegible.

This report describes how to use the FORIG computer code to solve isotope-generation and depletion problems in fusion and fission reactors. FORIG is an adaptation of ORIGEN2 to run on a Cray-1 computer, and to accept more extensive activation cross sections.

59024 (UCRL—86029) **Development of a high-density energy-storage capacitor for Nova.** Haskell, D.K.; Cooper, R.A.; Sevigny, J.A.; Merritt, B.T.; Carder, B.M.; Whitham, K. (Lawrence Livermore National Lab., CA (USA); Maxwell Labs., Inc., San Diego, CA (USA)). 22 Oct 1981. Contract W-7405-ENG-48. 6p. (CONF-811040—146). NTIS, PC A02/MF A01. Order Number DE82006772.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

Portions of document are illegible.

This paper covers Maxwell's approach to developing energy storage capacitors. Based on previous capacitor designs of 3 KJ, 5 KJ and 10 KJ, the final Nova 12.5 KJ capacitor evolved. At the outset of the Nova capacitor development program, a relatively new dielectric system, polypropylene-paper-DOP, seemed to show superiority in volumetric efficiency, life, and more importantly cost. However, as a result of studies performed at Maxwell, a high-density, energy-storage capacitor was developed utilizing new high-quality, high-density paper and caster oil as the dielectric. Test data have demonstrated that the Maxwell 12.5 KJ capacitor exceeds all LLNL's qualification requirements.

59025 (UCRL—87114) **Lawrence Livermore National Laboratory laser-fusion program.** Ahlstrom, H.G. (Lawrence Livermore National Lab., CA (USA)). 12 Jul 1982. Contract W-7405-ENG-48. 42p. (CONF-820930—5). NTIS, PC A03/MF A01. Order Number DE82020167.

From 9. international conference on plasma physics and controlled nulcear fusion research; Baltimore, MD, USA (1 Sep 1982).

The goals of the Laser-Fusion Program at Lawrence Livermore National Laboratory are to produce well-diagnosed, high-gain, laser-driven fusion explosions in the laboratory and to exploit this capability for both military applications and for civilian energy production. In the past year we have made significant progress both theoretically and experimentally in our understanding of the laser interaction with both directly coupled and radiation-driven implosion targets and their implosion dynamics. We have made significant developments in fabricating the target structures. Data from the target experiments are producing important near-term physics results. We have also continued to develop attractive reactor concepts which illustrate ICF's potential as an energy producer.

59026 **(UCRL—87749) Future engineering needs of mirror fusion reactors.** Thomassen, K.I. (Lawrence Livermore National Lab., CA (USA)). 30 Jul 1982. Contract W-7405-ENG-48. 25p. (CONF-820838—2). NTIS, PC A02/MF A01. Order Number DE82019434.

From Future engineering development needs for magnetic fusion workshop; Washington, DC, USA (3 Aug 1982).

Fusion research has matured during the last decade and significant insight into the future program needs has emerged. While some will properly note that the crystal ball is cloudy, it is equally important to note that the shape and outline of our course is discernable. In this short summary paper, I will draw upon the National Mirror Program Plan for mirror projects and on available design studies of these projects to put the specific needs of the mirror program in perspective.

59027 **(UCRL—87779) Electron energy distributions, vibrational population distributions, and negative-ion concentrations in hydrogen discharges.** Hiskes, J.R.; Karo, A.M. (Lawrence Livermore National Lab., CA (USA)). 28 Jun 1982. Contract W-7405-ENG-48. 31p. (CONF-820731—1). NTIS, PC A03/MF A01. Order Number DE82019313.

From North Atlantic Treaty Organization Advanced Study Institute conference on atomic and molecular processes in controlled thermonuclear research; Palermo, Italy (19 Jul 1982).

We consider the negative ion concentrations in hydrogen discharges caused by electron excitation and dissociative attachment processes. The principal formation and destruction processes are discussed for electron densities in the range 10^8 to 10^{13} electrons cm^{-3}. Expressions are developed for calculating the high energy portion of the electron energy distribution in the discharge; using these energy distributions the electron excitation rates are evaluated. At low densities, the vibrational distribution arises from singlet electronic excitations and triplet excitations through the $^3\pi$/sub u/ state, in equilibrium with wall de-excitation processes. At high densities singlet excitations predominate in equilibrium with atom-molecule de-excitation processes. Possibilities for negative ion generation in a two-chamber tandem system are discussed in which the vibrational excitation occurs in a high power, high electron temperature discharge, kT/sub e/ = 5 eV, and dissociative attachment occurs in a low temperature kT/sub e/ = 1 eV, plasma chamber.

59028 **(UCRL—87803) Time-dependent Stark-broadening measurements in planar-laser target experiments.** Lee, R.W.; Kilkenny, J.D.; Kauffman, R.L.; Matthews, D.L. (Lawrence Livermore National Lab., CA (USA); Imperial Coll. of Science and Technology, London (UK)). 9 Jul 1982. Contract W-7405-ENG-48. 20p. (CONF-820732—1). NTIS, PC A02/MF A01. Order Number DE82019117.

From International union of pure and applied physics conference; Boulder, CO, USA (12 Jul 1982).

Recent experiments at the Rutherford Laboratory Central Laser Facility using a single beam frequency doubled neodymium glass laser irradiating an assortment of planar targets are described. We have measured the time dependent Stark broadening of the AL XIII Lyman series lines using a streaked x-ray crystal spectrograph with a temporal resolution of 80 ps. We analyzed the results using standard line broadening theory which is presented for the high lying Lyman lines. The comparison between the time integrated and time dependent spectral lines will be presented. The results illustrate the possibilities now available for characterization of planar target plasmas.

59029 **(UTIAS—251) Gas target neutron generator studies.** Chatoorgoon, V. (Toronto Univ., Ontario (Canada)). Oct 1981. 152p. NTIS, PC A08/MF A01.

Heat deposition in a subsonic flow can cause the formation of gas density gradients which constitute useful gas targets. The variation of beam voltage, gas density, gas pressure, gas temperature, etc., within a subsonic channel were calculated as a function of the system parameters: beam voltage, beam current, channel diameter, stagnation tank temperatue and pressure. The analysis is presented as applicable to any combination of beam particle and target gas. It was found that the subsonic gas target (SGT) is stable against all small perturbations and against certain types of large perturbations. The closely-related transonic gas target (TGT) appears to be unstable to all perturbations. Comparison of hypersonic, transonic, and subsonic gas targets shows that the SGT is the most advantageous type and operates at a lower mass flow and at less severe stagnation tank conditions than the TGT or HGT. The problem of a deuterium spill into the tritium port of a straight hypersoni target was also investigated.

59030 **Flute stabilization by a cold line-tied blanket.** Segal, D.; Wickham, M.; Rynn, N. (Department of Physics, University of California, Irvine, California 92717). *Physics of Fluids;* **25**: No. 9, 1485-1487(Sep 1982).

The curvature-driven flute instability in an axisymmetric mirror was stabilized by an annular line-tied plasma blanket. A significant temperature difference was maintained between core and blanket. Theoretical calculations support the experimental observations.

59031 **Steady-state planar ablative flow.** Manheimer, W.M.; Colombant, D.G.; Gardner, J.H. (Plasma Theory Branch, Plasma Physics Division, Naval Research Laboratory, Washington, D.C. 20735). *Physics of Fluids;* **25**: No. 9, 1644-1652(Sep 1982).

Steady-state planar ablative flow in a laser produced plasma is studied. The calculations relate all steady-state fluid quantities to only three parameters, the material, absorbed irradiance, and laser wavelength. The fluid is divided into three regions; the subcritical expanding plasma, the steady-state ablation front, and the accelerated slab. Boundary conditions at the interfaces of these regions are given. If the absorbed irradiance is nonuniform, the nonuniformity in ablation pressure is calculated. Results are compared with experiment and fluid simulation for both uniform and nonuniform illumination.

59032 **Flow enhancement in magnetically insulated ion injectors.** Poukey, J.W.; Humphries, S. Jr.; Lockner, T.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physics of Fluids;* **25**: No. 8, 1471-1479(Aug 1982). Contract AC04-76DP00789.

Magnetically insulated gaps have proved useful for the production of high current density ion beams. Although ion flow well beyond conventional space charge limits has been observed, previous theoretical treatments have not predicted such flow enhancement at the magnetic fields typically used. One-dimensional numerical simulations are presented which demonstrate that trapped electron distributions are accessible that cancel much of the effect of ion space charge. This allows ion flow more than an order of magnitude higher than the Child limit. Two processes that result in modified electron distributions have been investigated; the use of a distributed initial electron source and electron diffusion across insulating field lines (specific instabilities were not studied). In both cases, high flow enhancement can be obtained with relatively small electron loss current.

59033 **APACHE: A low-background hard x-ray spectrometer for 10.6-μm laser fusion experiments.** Priedhorsky, W.; Lier, D. (Los Alamos National Laboratory, P.O. Box 1663 MS-410, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **53**: No. 8, 1189-1197(Aug 1982). Contract W-7405-ENG-36.

We describe a ten-channel hard x-ray spectrometer, named APACHE, which is used to diagnose target x-ray spectra at the HELIOS 10.6-μm laser fusion facility. Each channel consists of a filter, scintillator, and photodiode detector. Spectral bands are defined by filtration, and the choice of scintillator type and thickness. This scheme of channel definition gives broad spectral response channels, but it also yields large signals at the detector. This allows the use of insensitive photodiodes as detectors, reducing the effect of penetrating background. The two scintillators used, cesium fluoride and a lead-loaded plastic scintillator (NE142), have time responses of a few nanoseconds. The system is thus unable to resolve the 1-ns laser pulse, but is useful in isolating the target signal from laser electron beam, and possible target neutron, backgrounds. Cesium fluoride has a low scintillation response for $h\nu <$ or $=100$ keV, and is used for higher-energy channels; NE142, which is self-absorbing in thick sections, is used for low-energy channels. Both scintillators have been shown to be stable over a time scale of months. Because of the broad spectral response functions, the channel signals are fit to an exponential spectrum. Very good fits are obtained by this method. The APACHE results are corroborated by an independent thermoluminescent dosimeter system. A fast detector is used to provide $\sim$400 ps time resolution in a separated broad high-energy channel (named CYCLOPS). The agreement of the fast signal with that predicted from the APACHE spectrum demonstrates that APACHE measures the prompt hard x-ray signal. A linear relation is found between fastest ion velocity and APACHE kT/sub H/, providing an additional check of APACHE results. The APACHE system has proved convenient to field and free of background, and is a standard diagnostic at the HELIOS facility. We routinely measure hard x-ray yields of tens of joules from laser shots on high-Z targets.

59034 **Soft x-ray measurements from the PDX tokamak.** Silver, E.H.; Bitter, M.; Brau, K.; Eames, D.; Greenberger, A.; Hill, K.W.; Meade, D.M.; Roney, W.; Sauthoff, N.R.; Von Goeler, S. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **53**: No. 8, 1198-1213(Aug 1982). Contract AC02-76CH03073.

Temporally and spatially resolved profiles of the PDX soft x-ray spectra have been measured during single tokamak pulses of circular divertor plasmas with a recently developed pulse-height analyzer. This detection system incorporates an array of five vertically displaced sets of lithium-drifted silicon detectors, each consisting of three independent channels optimized for rapid data collection in adjacent energy regions. Simultaneous measurements of x-ray emission integrated along five chords of the plasma cross section can, thereby, be achieved. Abel inversion of these data yields temporally resolved radial profiles of the local electron temperature from the slope of the continuum, concentrations of high-Z impurities from the characteristic line intensities, and a measure of Z/sub eff/ from the continuum intensity. The techniques of x-ray pulse-height analysis, with illustrations featuring the results from the initial PDX circular plasma experiments, are discussed in detail. In addition, comparisons between circular and divertor plasmas on PDX, derived from the x-ray measurements, are also presented.

59035 **Sensitivity of capacitance diaphragm manometers to static magnetic fields.** Dylla, H.F.; Provost, T.J. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08544). *Journal of Vacuum Science and Technology;* **21**: No. 2, 707-708(Jul 1982). Contract AC02-76CH03073.

The sensors of the two capacitance diaphragm manometers investigated in this study appear to have no significant dependence upon exposure to static magnetic fields. Subsequent use of the sensors in the near-field environment of the PDX tokamak showed the sensors could perform unshielded in a magnetic environment, however, it was found necessary to magnetically shield the associated signal-conditioning electronics.

59036 **Magnetic-field—induced surface transport on laser-irradiated foils.** Forslund, D.W.; Brackbill, J.U. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **48**: No. 23, 1614-1617(7 Jun 1982).

Electrons heated by absorption of laser energy are shown to generate intense magnetic fields which rapidly spread from the edge of the laser spot along the target surface. The fields convectively transport hot electrons and confine a major fraction of the deposited laser energy in the corona. Eventually, this energy is lost to fast-ion blowoff or deposited at large distances from the spot. This model qualitatively explains many experimental observations of thermal-transport inhibition and fast-ion loss.

59037 **Evaporation of pellets injected into tokamak plasmas and the classical flux-limit parameter.** Mayer, F.J. (KMS Fusion Inc., Ann Arbor, Michigan 48106). *Physical Review Letters;* **48**: No. 20, 1400-1403(17 May 1982). Contract AC08-78DP40030.

The steady-state saturated-evaporation theory of a cold cloud in a hot tenuous atmosphere developed by Cowie and McKee is applied to the evaporation of pellets injected into tokamak plasmas. The agreement with limited experimental results is found to be quite good, and extrapolation of the theory to a reactor-size tokamak indicates a required pellet injection velocity of 5 x 10^6 cm/sec. Finally, the experimental evaporation times can be viewed as a measurement of the "classical" flux-limit parameter, which is found to be $f = 0.6$.

59038 **Applications of rep-ratable mass accelerators (such as MAID).** Tidman, D.A.; Goldstein, S.A. (JAYCOR, Alexandria, VA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-18**: No. 1, 115-120(Jan 1982). (CONF-801138—).

From Electromagnetic guns and launchers conference; San Diego, CA, USA (4 Nov 1980).

Several applications of mass-accelerators are discussed with emphasis on impact fusion as one of the most ambitious goals for such devices. Many applications require that the accelerator be capable of being repetitively fired. 20 refs.

59039 **Concepts and limitations of macroparticle accelerators using travelling magnetic waves.** Wipfs, S.L. (Los Alamos Natl Lab, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-18**: No. 1, 121-126(Jan 1982). (CONF-801138—).

From Electromagnetic guns and launchers conference; San Diego, CA, USA (4 Nov 1980).

The concept of an accelerator using a travelling magnetic wave that acts on magnetized projectiles is discussed. Although superconductors potentially may be good projectile material, their low critical temperature makes them unsuitable. Among ferromagnetic materials, dysprosium seems superior. For stable suspension and guidance, a high conductivity (preferrably superconducting) guide sheet is necessary. Magnetic field gradients of 10/sup 9/ amp/m/sup 2/ travelling at 10/sup 6/ m/s should be achievable using present state-of-the-art components; resulting accelerations are /APP GRTH/500 km/s/sup 2/. A linear accelerator for final speeds of 50 km/s needs a length of 2.5 km. Guidance forces sufficient to produce acceleration of 2*10/sup 6/ m/s/sup 2/ allow circular accelerators of reasonable size to achieve hypervelocities for small (50-100 mg) projectiles. An accelerator of 170-m diam would surpass the best results from light gas guns. Travelling waves suitable for accelerations of 10/sup 4/-m/s/sup 2/ can be produced without switching by means of flux displacing rotors and may be adapted to circular accelerators. 10 refs.

59040 **Review of melting and evaporation of fusion reactor first walls.** Fillo, J.A.; Makowitz, H. (Brookhaven Natl Lab, Upton, NY). *American Society of Mechanical Engineers, [Paper];* No. 81-WA/HT-33, vp(Nov 1981).

The most severe thermal loading on the first wall will occur when the plasma becomes unstable resulting in a hard plasma disruption or at the end of a discharge when the plasma is dumped on the wall in a very short period of time. Hard plasma disruptions are of particular concern in future fusion reactors where the thermal energy of the plasma may reach values on the order of 300 MJ. 16 refs.

59041 **Particle accelerator conference, accelerator engineering and technology, 1981.** Placious, R.C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 3, 1961-3616(Jun 1981). (CONF-810314—).

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The proceedings contain 506 papers, of which 281 are separately indexed. The topics covered include: high-energy particle accelerators; low and intermediate energy circular accelerators; accelerator technology; beam dynamics; particle sources, electrostatic accelerators; applications of accelerators; new accelerator techniques, intense beams; and linear accelerators.

59042 The Office of Fusion Energy Fusion Engineering Development plan. Baublitz, J.; Dowling, R.; Haas, G.; Reuther, T. (DOE, Washington D.C. 20545). *Transactions of the American Nuclear Society;* **39**: 235(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59043 Doublet III results and implications for future tokamaks. Group, D.I. III; Group, J.P. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **39**: 235-236(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59044 INTOR. Stacey, W.M. Jr. (Georgia Inst Tech, Atlanta, GA 30332). *Transactions of the American Nuclear Society;* **39**: 236-238(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59045 End plug designs for tandem mirror reactors with thermal barriers. Carlson, G.A. (LLNL, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **39**: 242-243(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59046 SEBREZ: an inertial fusion chamber concept. Meier, W.R. (LLNL, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **39**: 246-247(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59047 A fission-suppressed helium-cooled blanket for the TMHR. Cheng, E.T.; Creedon, R.L.; Maya, I.; Schultz, K.R.; Trester, P.W.; Wong, C.P.C. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **39**: 251-253(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59048 The feasiblity of using a beryllium neutron multiplier component in a TMR. Cheng, E.T.; Simnad, M.T.; Trester, P.W. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **39**: 255-257(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59049 Relationship of material properties to the design of a fusion reactor first wall. Meyer, J.E.; Yu, G.P. (MIT, Cambridge, MA 02139). *Transactions of the American Nuclear Society;* **39**: 259-260(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59050 Effect of preferential sputtering on first wall alloys. Andreadis, T.D.; Davarya, F.; Goktepe, O.F.; Pertmer, G.A.; Roush, M.L. (Univ of Maryland, College Park, MD 20742). *Transactions of the American Nuclear Society;* **39**: 260-261(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59051 Fatigue crack growth in HYPLIFE reaction chamber components. Pitts, J.H. (LLNL, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **39**: 261(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59052 Mechanical and structural considerations for INTOR tritium breeding blanket design. Abdou, M.A.; Bowers, D.A.; Clemmer, R.G.; Delaney, M.J.; Finn, P.A.; Jung, J.; Misra, B.; Morgan, G.D.; Smith, D.L. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **39**: 265-266(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59053 An analysis of the separation of protium from blanket tritium product streams. Maroni, V.A.; Misra, B. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **39**: 270-271(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59054 Tritium confinement and recovery considerations for Li17P683 fusion blankets. Cheng, E.T.; Sze, D.K. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **39**: 271-272(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59055 Evaluation of n + 7Li reactions using variance-covariance techniques. Young, P.G. (LANL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **39**: 272-274(1981). (CONF-811103—).

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

59056 Fueling moving ring field-reversed mirror reactor plasmas. Felber, F.S. (Gen At Co, San Diego, CA). *Nuclear Technology;* **50**: No. 2, 119-123(Sep 1980).

The concept of small fusion reactors is being studied jointly by Lawrence Livermore Laboratory General Atomic Company, and Pacific Gas and Electric Company. The objective is to investigate alternatives and then to develop a conceptual design for a small reactor that could produce useful, though not necessarily economical, energy by the late 1980s. Three methods of fueling a small moving ring field-reversed mirror are considered: injection of fuel pellets accelerated by laser ablation, injection of fuel pellets accelerated by deflagration-gun ablation, and direct injection of plasma by a deflagration gun. 13 refs.

59057 Comparative study of tritium breeding performance of lithium, Li_2O, and Li_7Pb_2 blankets in a tokamak power reactor. Jung, J. (Argonne Natl Lab, IL). *Nuclear Technology;* **50**: No. 1, 60-82(Aug 1980).

A nuclear analysis of tritium breeding performance has been carried out for three candidate breeding materials of liquid lithium, solid Li/sub 2/O, and solid Li/sub 7/Pb/sub 2/. The tritium breeding characteristic in each breeder material and the effects of graphite reflector and beryllium neutron multiplier are studied. The impact of the tritium breeding on the minimum blanket/shield thickness requirement for the TF-magnet protection is analyzed in detail. Discussions are made on space allowances for the nonbreeding inner blanket concept and major penetrations. The analysis of the characteristic neutron spectra in the three breeder materials, and the analysis of the effect of helium-coolant volumes in the solid Li/sub 2/O and Li/sub 7/Pb/sub 2/ compounds are presented. 23 refs.

59058 Use of yttrium for the recovery of tritium from lithium at low concentrations. Buxbaum, R.E.; Johnson, E.F. (Princeton Univ, NJ). *Nuclear Technology;* **49**: No. 2, 307-314(Jul 1980).

A particularly difficult problem for first-generation fusion power reactor systems is the recovery of tritium at very low concentration levels from the reactor blanket when lithium metal is the principal tritium breeding medium. On the basis of recent data and reasonable extrapolations, the authors show that it is likely that yttrium metal can be used to extract tritium from lithium at concentrations as low as 10/sup -6/ atom fraction tritium in lithium under conditions that are practicable for commercial power machines. 26 refs.

59059 **Investigation of nonmetallic element interactions in vanadium-alloy/lithium systems.** Smith, D.L.; Lee, R.H.; Yonco, R.M. (Argonne Natl Lab, IL). pp 2.72-2.80 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

The compatibility of vanadium and vanadium-base alloys with liquid lithium is being evaluated in a loop constructed of a stainless steel-clad vanadium-15 wt % chromium alloy. Information on the distribution of hydrogen and nitrogen between lithium and the vanadium-base alloys is reported. Interactions of nonmetallic elements in lithium with titanium, zirconium, and yttrium were also investigated to determine the effectiveness of these metals for controlling the concentrations of hydrogen, nitrogen, carbon, and oxygen in lithium. 12 refs.

59060 **Liquid metals in tokamak reactor blankets.** Smith, D.L.; Gold, R.E. (Argonne Natl Lab, Ill). pp 10.21-10.32 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Tokamak blanket applications for which liquid metals or alloys are potential candidates include: breeding tritium, the coolant, and neutron multiplication. Of various liquid metals considered, liquid lithium as the breeder/coolant offers the most advantages. The Li-Pb-Bi system appears to be the best alternate. Pb-Bi has attractive properties for the neutron multiplier. 18 refs.

59061 **Impurity meters for liquid lithium systems.** Down, M.G. (Westinghouse Electr Corp, Pittsburgh, Pa). pp 14.16-14.22 of International conference on liquid metal technology in energy production proceedings, 2nd, 1980. Dahlke, J.M. (ed.). Washington, DC; American Nuclear Society (1980).

From 2. international conference of liquid metal technology for energy systems; Richland, WA, USA (20 Apr 1980).

Results of feasibility testing of permeation-type hydrogen meters and galvanic cell oxygen meters are reported. 34 refs.

59062 **Argonne National Laboratory superconducting pulsed coil program.** Wang, S.T.; Kim, S.H. (Argonne National Lab., IL (USA)). pp 90-109 of Superconductive energy storage. Nishimura, M. (ed.). Osaka, Japan; Kuroki Publishing Company (1980).

From International symposium on superconductive energy storage; Osaka, Japan (8 Oct 1979).

Argonne National Laboratory (ANL) has recognized the clear advantage of a superconducting ohmic heating coil and started an aggressive development program in FY 1977. The main objectives are to develop high current (-- 100 kA) cryostable cable configurations with reasonably low ac losses, to build a demonstration pulsed coil, and to develop a rather inexpensive large fiberglass reinforced helium cryostat. A 1.5-MJ cryostable pulsed superconducting coil has been developed and constructed at ANL. The coil has a peak field of 4.5 T at an operating current of 11.0 kA. A large inexpensive plastic cryostat has been developed for testing the pulsed coil. The coil has been pulsed with a maximum dB/dt of 11 T/s. The coil was pulsed more than 4000 cycles. Detailed results of the ac loss measurements and the current sharing of the cryostability will be described. Other objectives of the on-going pulsed coil program is to study the parallel operation of pulsed coils, to develop and evaluate a 50-kA and 100-kA cryostable cable and to perform a preliminary engineering design of a 100-MJ engineering demonstration coil.

59063 **Conceptual design of a superconductive energy and transfer system for a commercial tokamak EF coil.** Fuja, R.E. (Argonne National Lab., IL (USA)). pp 122-126 of Superconductive energy storage. Nishimura, M. (ed.). Osaka, Japan; Kuroki Publishing Company (1980).

From International symposium on superconductive energy storage; Osaka, Japan (8 Oct 1979).

A conceptual design has been developed for a superconducting energy storage coil and a dc-ac-dc three phase converter which match the voltage and current requirements of the equilibrium field (EF) coil in a commercial tokamak reactor. The system can generate 13 kV, 26 kA peak, 15 kA rms for 15 sec to charge or discharge the EF coil. A hypothetical example utilizing this design and component cost analysis are given. The current and voltage profiles for the EF coil presented here were obtained from a February 1979 Argonne National Laboratory technical memorandum[1] on power supply requirements for a tokamak.

59064 **Cryostable superconductors in energy storage systems.** Furuto, Y.; Meguro, S. (Furukawa Electric Co. Ltd., Tokyo (Japan). Central Research Lab.). pp 205-209 of Superconductive energy storage. Nishimura, M. (ed.). Osaka, Japan; Kuroki Publishing Company (1980).

From International symposium on superconductive energy storage; Osaka, Japan (8 Oct 1979).

A brief review is made of the superconductors used for energy storage magnets and cryostable superconductors manufactured in Japan, 200 meters of the large-current conductor with the cross section of 27 mm x 12.8 mm and with the critical current of about 20 KA at 8T have been recently manufactured. The designs and test results of the conductor are described. Finally, a conceptual design of 50 KA conductors for the energy storage coil rated 100 - 1,000 MWH is presented.

59065 **Aspects of superconductive energy storage systems for supply of fusion magnets.** Komarek, P.; Ulbricht, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). pp 32-38 of Superconductive energy storage. Nishimura, M. (ed.). Osaka, Japan; Kuroki Publishing Company (1980).

From International symposium on superconductive energy storage; Osaka, Japan (8 Oct 1979).

The demand of pulsed power for fusion reactors and the method of supplying the pulsed power are discussed. The requirements for energy and power are as follows. The energy requirement is 5 x 10^9 Ws, the time step is several seconds, and the apparent power is 10^9 VA. An established technique to supply the pulsed power demand of fusion magnets is the use of flywheel motor-generator sets supported by the grid. There exist different indications that superconducting energy storage units with capacitive acting machines or converter can become a more attractive alternative. One constraint is the high voltage technology to be applied for such storage coils, especially its influence on costs and reliability. The main fields of problems which had to be solved and handled were material properties at high voltage, component design at high voltage, testing methods, the quench protection of coils at high voltage and transient behavior in components. Discussions about these problems are presented in this paper.

59066 **Buckling of a superconducting ring in a toroidal magnetic field.** Moon, F.C. (Cornell University, Ithaca, NY). *Journal of Applied Mechanics;* **46**: 151-155(Mar 1979).

Experimental evidence and a theoretical model are presented for the magnetoelastic buckling of a rigid superconducting ring in a steady circumferential (toroidal) magnetic field. The theoretical model predicts a coupled translation and pitch displacement of the coil in the buckled mode. A discussion is given of both the linear and nonlinear magnetic perturbation forces. The experiments were conducted in liquid helium (4.2 K). The lowest natural frequency of the rigid coil on elastic springs was observed to decrease near the buckling current. Agreement between theory and experiment is fair. These results may have design implications for poloidal field coils in magnetic fusion Tokamak reactors.

59067 **Tritium System Test Assembly control-system cost estimate.** Stutz, R.A. (Los Alamos Scientific Lab., NM). *Transactions of the American Association of Cost Engineers;* B.7.1-B.7.7(1979). (CONF-790715—).

From 23. annual meeting of the American Association of Cost Engineers; Cincinnati, OH, USA (15 Jul 1979).

The Tritium Systems Test Assembly (TSTA), is dedicated to the development, demonstration and interfacing of technologies related to the deuterium-tritium fuel cycle for the fusion reactor systems. Tritium, an isotope of hydrogen, will be a major fuel for fusion reactor systems. The principal objectives for TSTA can be concisely stated: demonstrate the fuel cycle for fusion power reactors; develop, test and qualify equipments for tritium service in the fusion program; develop and test environmental and personnel protective systems; provide a final facility that can be used for demonstration and as an example that could be directly copied by industry; demonstrate long-term reliability of components; demonstrate long-term safe handling of tritium with no major releases or incidents; and investigate and evaluate a response of the fuel cycle and environmental packages to normal, off-normal and emergency situations.

59068 **Survey of mirror machine reactors.** Condit, W.C. (California University, Livermore, CA). pp 651-680 of Diagnostics for fusion experiments. Proceedings of the course, Varenna, Italy, September 4-16, 1978. Sindoni, E.; Wharton, C. Oxford, England; Pergamon Press (1979). Contract W-7405-ENG-48.

From International school of plasma physics; Varenna, Italy (Sep 1978).

The paper examines the Magnetic Mirror Fusion Program. Starting from the simple axisymmetric mirror concept the program overcame gross flute-type instabilities and the most serious microinstabilities. Dense plasmas approaching the temperature range for fusion were produced, and extensive design studies of mirror configurations led to three designs: the standard mirror fission-fusion hybrid, tandem mirror, and the field-reversed mirror. Typical plasma parameters are given for each type of machine, concluding that in a working fusion reactor, diagnostics will be required for operational control.

59069 **Mirror position display equipment for the target chamber mirror mounts of the LASL HELIOS laser fusion facility.** Wells, F.D.; Remington, D.A. (California University, Los Alamos, NM). pp 4.8-4.12 of Engineering - key to the future. Region VI conference, Sacramento, California, April 25-27, 1979, conference record. New York, NY; IEEE (1979).

From IEEE region six conference; Sacramento, CA, USA (25 Apr 1979).

Equipment has been fabricated which records the absolute positions of sixteen mirror mounts used to direct and focus eight high-energy laser beams for research in laser induced fusion. Each mirror mount is driven by three stepping motors, controlled to produce the motions of Focus, Tilt, and Rotate relative to the target. Stepping of the motors is sensed by incremental optical encoders coupled to the motor drive shafts. Outputs from the encoder tracks are multiplexed to a microprocessor which transmits motor step information via a fiber optical data link to a Mirror Position Display chassis. This unit accumulates the steps, stores the motor positions, displays mirror position data to the operator, and provides the equipment control functions. Standby battery power is included to retain the motor step data in the event of power failure.

59070 **Non-electric fusion energy applications.** Bogart, S.L. (U.S. Department of Energy, Div. of Magnetic Fusion Energy, Washington, D.C.). pp 371-402 of Driven magnetic fusion reactors. Proceedings of the course, Erice, Italy, September 18-26, 1978. Oxford, England; Pergamon Press (1979).

From Driven magnetic fusion reactors; Erice, Italy (18 Sep 1978).

Studies aimed at assessing the feasibility of nonelectric fusion energy applications are reviewed, with particular reference to the Inexhaustible Energy Resources Planning Study. Particular attention is given to fusion-fission energy systems and synthetic chemical fuel production by fusion reactors.

59071 **Polytran NaCl windows for LASL Antares CO_2 Laser System.** Straughan, V.E. (Harshaw Chemical Co., Crystal and Electronic Products Dept., Solon, OH). pp 106-111 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

A review is given of the technology and special facilities applied in the production of 18-inch diameter Polytran NaCl windows. These optical elements are to be employed in the LASL Antares CO_2 Laser System. Procedures in achieving window specifications are discussed.

59072 **LOTS analysis of optical diffraction in Antares.** Wolfe, P.N. (California, University, Los Alamos, N. Mex.); Saxman, A.C. (California, University, Los Alamos, N. Mex.; Arizona, University, Tucson, Ariz.). pp 232-237 of Los Alamos Conference on Optics. Liebenberg, D.H. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1979).

From Conference on Optics; Los Alamos, NM, USA (23 May 1979).

Diffraction and aberration effects are calculated for the power-amplifier and target-system portions of the 100-kJ Antares laser fusion facility, using LOTS, a fast-Fourier-transform propagation code incorporating a model for saturating gain in CO_2. Energy losses due to diffraction are found to be small compared to other losses. Diffraction 'hot spots' usually typical of propagation at low Fresnel numbers are effectively suppressed in the Antares power amplifier by gain saturation. Taking account of diffraction and aberrations over the whole optical train, the code predicts a target focal spot that has 82% of its energy in a 150-micron-diameter circle, a result essentially identical to what would be expected of the final focus mirror alone.

99 GENERAL AND MISCELLANEOUS

59073 **(NP—2903467) Scientific activities 1979: nuclear Research Centre Demokritos.** (Atomic Energy Commission, Athens (Greece)). 1981. 134p. Dep. NTIS (US Sales Only), MF A01. Order Number DE82903467.

Portions of document are illegible.

This edition covers the scientific activities of the Nuclear Research Center Demokritos for the year 1979. Each division has a number of projects which are listed individually. The title of the project, the objectives, the year of commencement of the program, the name of the head of the project, developed activities, publications, report etc., are listed for each project.

9901 Management

REFER ALSO TO CITATION(S) 57053

59074 **(LBL—13613) 50th Anniversary, 1931-1981: symposium and banquet speeches.** (Lawrence Berkeley Lab., CA (USA)). 3 Oct 1981. Contract W-7405-ENG-48. 164p. (CONF-8110222—). NTIS, PC A08/MF A01. Order Number DE82013635.

From Symposium and banquet speeches of the celebration of the 50th anniversary of Lawrence Berkeley Laboratory; Berkeley, CA, USA (3 Oct 1981).

The proceedings includes talks given at the symposium and the banquet. They include examples of technology at the laboratory and speculation on the future at the laboratory. (GHT)

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 56266, 56791, 58006, 58415, 58801

59075 (BNL—30609) Traditional computing center as a modern network node. Heller, S.; Peskin, A.M. (Brookhaven National Lab., Upton, NY (USA)). Nov 1981. Contract AC02-76CH00016. 17p. NTIS, PC A02/MF A01. Order Number DE82006935.

There is an obvious trend toward decentralization of computing power from the traditional, large computing center. Even so there remains a generous, but changing role for such centers to play. Their capabilities would then be complimentary to smaller, individualized facilities, so the user would benefit greatly from a general purpose, local network on which the large center represented a node. There is no network currently available that exhibits all the attributes of the ideal local for this environment. It can be approached, however, by combining several diverse products as network segments, which are interconnected via processor gateways. This is in fact the strategy being followed at Brookhaven National Laboratory, which has a computing environment typical of a large class of institutions. The attributes of the ideal network are presented. A brief discussion of the current state-of-the-art in networking is then given. Finally, the particulars of the Brookhaven implementation are offered as a case history.

59076 (CERN—81-12) CERNET: a high-speed packet-switching network. Gerard, J.M. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 22 Dec 1981. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82702210.

A general mesh-structured high-speed computer network has been designed and built. This network provides communication between any pair of connected user computers over distances of upto 6 km and at line speeds of 1 to 5 Mbit/second. The network is composed of a communication subnet providing a datagram service, complemented by tasks in the connected machines to implement an end-to-end logical link protocol. Details are given of the overall structure as well as the specific modules of which the system is composed.

59077 (CERN—81-16) Least squares methods in physics and engineering. Bjoerck, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 19 Nov 1981. 66p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82702211.

These lectures deal with numerical methods representing the state of the art, including the available computer software. First a brief background of basic matrix factorizations is given. Dense linear problems are then treated, including methods for updating the solution when rows and variables are added or deleted. Special consideration is given to weighted least squares problems and constrained problems. Regularization of ill-posed problems are briefly surveyed. Sparse linear least squares problems are treated in some detail. Different ordering schemes, including ordering to block-angular form and nested dissection, and iterative methods are discussed. Finally a survey of methods for nonlinear least squares problems is given. The Gauss-Newton method is analyzed and its local convergence derived. Levenberg-Marquardt methods are discussed and different methods using second derivative information surveyed. Special methods are given for separable linear-nonlinear problems.

59078 (CNEN-RT/EDP—(80)6) BC graphics system - user's guide. Panini, G.C. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Dipartimento Ricerca Tecnologica di Base ed Avanzata). Nov 1980. 51p. (In Italian). Dep. NTIS (US Sales Only), MF A01. Order Number DE82903021.

Portions of document are illegible.

The BC System is a package of inter-related subroutines entirely written in FORTRAN IV to graphically display computer data. In order to produce graphics output a FORTRAN programme is written to perform whatever computations and/or graphics manipulations are needed to produce the desired image. Its features include portability, device independent, modularity and easy to use. The main entry points of the System are here described.

59079 (CONF-820740—1) Portable software package for nonlinear partial differential equations. Neuberger, J.W.; Renka, R.J. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE82018261.

From SIAM 30th annuversary meeting; Stanford, CA, USA (19 Jul 1982).

This paper describes a storage-efficient method and associated software package for the solution of a general class of second-order nonlinear partial differential equations. The method is essentially an iterative scheme for the least squares minimization of a finite difference discretization of the residual. The advnatages of this approach are its ability to treat a wide range of problems (it is type-independent) and its low storage requirements - O(N) for N grid points. The effectiveness of the method is based on a gradient-smoothing technique which increases the rate of convergence of the iterative procedure.

59080 (DEMO—80/7) M-8000: an assembly language for the INTEL-8080 microcomputer. Skordalakis, E. (Atomic Energy Commission, Athens (Greece)). Nov 1980. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82902784.

Portions of document are illegible.

An assembly language for the INTEL-8080 microcomputer, namely the M-8080, is described in this report. M-8080 belongs to the DGCAS family of similar assembly languages and as such it can be translated by DGCAS which is a homemade Meta-Assembly System *(a meta-assembler + a meta-linking loader). M-8080 is a powerful assembly language but it is incompatible with the INTEL-8080 assembly languages offered by INTEL corporation. This report is both a reference manual for the M-8080 assembly language and an implementation manual for the cross tools which translate M-8080.

59081 (EDF-R—81H331065) Computed estimation of density. Pantin, A.L.; Molliere, J.L. (Electricite de France, 92 - Clamart. Service Informatique et Mathematiques Appliquees). Mar 1981. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82702344.

This note presents a programme of assessment of the density f(x) of a law as from an x_1, x_2, ...,xsub(n) sample of n size which enables the fsub(n)(x) assessment to be calculated automatically, and provides the possibility of furnishing an automatic plot of the density curve on a Benson plotting table.

59082 (EGG-FE—5842) Identification of multivariate linear systems. Griffith, J.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1982. Contract AC07-76ID01570. 63p. NTIS, PC A04/MF A01. Order Number DE82015201.

Portions of document are illegible.

Multivariate identification problems are treated with a least-squares approach. A chapter on scalar problems focuses attention on the classical parameter-estimate bias problem caused by measurement noise and develops a straightforward and effective way to remove the bias. A chapter on multivariate problems generalizes the bias removal method and develops a form selection procedure. The form selection procedure generally ensures more accurate identification than is possible with identification methods which rely on a fixed form. The concept of a form selection procedure is new to this work. A results chapter presents four example problems. Each example illustrates specific features of the identification technique. As a collection the examples emphasize the complexity of system identification and demonstrate that identification techniques will perform well when carefully applied.

59083 (JAERI-M—9592) Manual on unit conversion program library UCL2. Abe, Kiyoharu. (Japan Atomic Energy Research Inst., Tokyo). Jul 1981. 96p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82702213.

The unit conversion program library UCL2 has been developed. This library is the expanded and modefied version of UCL1, which was developed for the unit conversion for dynamics and thermodynamics. Using this library, the user can obtain the accurate unit conversion factors between arbitrary units in consistent way. UCL2 has two major functions. The first one is to register the information of dimensions, units and unit systems. This work can be done automatically by the program and/or individually according to the user's selection. The second one is to obtain the unit conversion factor from a certain unit to the unit with same dimension in a certain unit system. Besides, UCL2 has many utility subprograms including character handling programs and unit conversion factor printing-out programs. The application of UCL2 to computer codes will not only improve the accuracy of the codes but prevent careless mistakes in programming about unit conversion. Especially, various correlation programs, the development of which takes a large part of programming work for a large scale computer code, can be developed so that they may be used for any unit system, which will result in the decrease of programming work significantly. Unit conversion factor tables for various physical quantities in dynamics and thermodynamics field were produced from a sample run and are listed in the appendix.

59084 **(KFK—3156) Software monitor in a central computer supervising several microcomputers.** Heep, W.; Rietzschel, K.; Rusch, K.D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Datenverarbeitung und Instrumentierung). Mar 1981. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82902716.

Several autonomous microcomputers are coupled by a serial interface to a central computer. A basic instruction set allows exchange of data and control information. The process is synchronized and controlled by event flags. Terminal orientated commands allow the user to supervise and modify the process activities.

59085 **(LA—9244-MS) Casual User Project: problems, proposed solutions, and implementation.** Prommel, J. (Los Alamos National Lab., NM (USA)). May 1982. Contract W-7405-ENG-36. 60p. NTIS, PC A04/MF A01. Order Number DE82016407.

This report responds to requests from the Computer User's Priorities Task Force 2 to address the needs of casual users of the Los Alamos Computing Network. Problems, proposed solutions, and the status of implementation of those proposed solutions are discussed for seven major categories. These categories are orientation, education, physical reorganization, user input, documentation, consulting services, and user/network interface.

59086 **(LBL—13287) Adaptive finite-difference method for hyperbolic systems in one space dimension.** Bolstad, J.H. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract AC03-76SF00098. 217p. NTIS, PC A10/MF A01.

Thesis. Submitted to Stanford Univ., CA.

Many problems of physical interest have solutions which are generally quite smooth in a large portion of the region of interest, but have local phenomena such as shocks, discontinuities or large gradients which require much more accurate approximations or finer grids for reasonable accuracy. Examples are atmospheric fronts, ocean currents, and geological discontinuities. This thesis develops and partially analyzes an adaptive finite difference mesh refinement algorithm for the initial boundary value problem for hyperbolic systems in one space dimension. The method uses clusters of uniform grids which can move along with pulses or steep gradients appearing in the calculation, and which are superimposed over a uniform coarse grid. Such refinements are created, destroyed, merged, separated, recursively nested or moved based on estimates of the local truncation error. A four-way linked tree and sequentially allocated deques (double-ended queues) are used to perform these operations efficiently. The local truncation error in the interior of the region is estimated using a three-step Richardson extrapolation procedure, which can also be considered a deferred correction method. At the boundaries we employ differences to estimate the error. Our algorithm was implemented using a portable, extensible Fortran preprocessor, to which we added records and pointers.

59087 **(NUREG—0917) Nuclear Regulatory Commission staff computer programs for use with meteorological data.** Snell, W. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1982. 141p. GPO $6.00.

The Nuclear Regulatory Commission (NRC) receives hour-by-hour meteorological data on magnetic tape in a format specified in Regulatory Guide 1.70, Revision 2, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (September 1975). The purpose of this report was to document the computer programs that are used by the NRC meteorology staff to examine, assess and utilize these hourly values of meteorological data. A description of each of the programs is given along with the input requirements, discussion of output, subroutine flow chart, a description of each subroutine, sample output and a program listing.

59088 **(ORNL/CSD/TM—159) Screening designs for response surface experiments.** Morris, M.D. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE82020486.

Screening experiments are discussed for the case in which the underlying model is a response surface polynomial of unknown degree. Systematic fractional replicate designs (Cotter, 1979) are discussed and extended for use in the response surface setting. A model selection strategy is outlined based on analysis of the designed experiment.

59089 **(ORNL/TM—7941) Resource data inventory for the Oak Ridge area.** Mann, L.K.; Kitchings, J.T. (Oak Ridge National Lab., TN (USA)). Aug 1982. Contract W-7405-ENG-26. 56p. NTIS, PC A04/MF A01. Order Number DE82020461.

Portions of document are illegible.

A natural resources data base is described that is useful in natural resource management on the Department of Energy Reservation at Oak Ridge, in research site selection on the National Environmental Research Park (NERP) within the Reservation, in summarizing and analyzing resource data in areas selected for industrial development in and near the Reservation, and in regional analyses both on the Reservation and on adjacent land. Soils, surface geology, slope classes, slope aspect, land use, and roads have been digitized on a 0.5-ha cell size for the Oak Ridge area. Two examples of using the data base with IMGRID, a data storage, retrieval, and modeling system developed by the Tennessee Valley Authority are presented. The first example is a search for barren or glade type soils and the second is a summary of forest productivity classes. Summary information concerning soil series distribution, most common soils, and taxonomy of soils is also included.

59090 **(SAND—80-1734) Starting step size for an ODE solver.** watts, H.A. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1982. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01. Order Number DE82020422.

One of the more critical issues in solving ordinary differential equations by a step-by-step process occurs in the starting phase. Somehow the procedure must be supplied with an initial step size that is on scale for the problem at hand. It must be small enough to yield a reliable solution by the process, but not so small as to significantly affect the efficiency of solution. In this paper, we discuss an algorithm for obtaining a good starting step size and present a subroutine which can be readily used in most ODE solvers.

59091 **(UCID—19486) Rescaling of equipotential smoothing.** Winslow, A.M.; Barton, R.T. (Lawrence Livermore National Lab., CA (USA)). 17 Aug 1982. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01. Order Number DE82020425.

A method is described for locally rescaling the curvilinear coordinates used in continuous rezoning of Lagrangian meshes by the equipotential method. In this way the zone aspect ratio may be brought closer to unity.

59092 **(UCID—19489) STR82: combined string and user-interface library for VAX/VMS, RSX-11M, and RT-11.** Garbarini, J.P. Jr. (Lawrence Livermore National Lab., CA (USA)). 10 Aug 1982. Contract W-7405-ENG-48. 66p. NTIS, PC A04/MF A01. Order Number DE82020701.

A combined string and user interface library was written to aid programmers in writing portable code. The library has been implemented under Digital Equipment Corporation (DEC) VAX/VMS, RSX-11M, and RT-11 operations systems for use with FORTRAN programs. This is a reference manual for STR82 which is a library containing string routines and user interface routines. Versions of the library exist for use with VAX-FORTRAN programs running under VAX/VMS and for use with either FORTRAN IV-PLUS or FORTRAN IV programs using PDP-11's running RSX-11M or RT-11. The manual is for programmers using the library on one or more of these systems. Included are the logical functions of the routines and their calling sequences.

59093 (UCID—30191) **MMG: a simple memory manager for FORTLIB.** Dubois, P.F. (Lawrence Livermore National Lab., CA (USA)). 4 Aug 1982. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01. Order Number DE82020424.

Portions of document are illegible.

Memory managers are extremely useful tools. They allow a programmer to write and modify quickly and easily codes involving arrays that have lengths not known at compile time. The popular A-Division memory manager, MMLIB, written by Bob Cooper, is based on BLIB. Cooper's product is sophisticated and has many capabilities. The manager MMG, described here, is simple, but will satisfy most needs and is compatible with FORTLIB. It can manage one to ten different blocks of memory, allocating and releasing arrays within a block at the user's command. One of the blocks can be the space at the end of memory. In this mode, MMG uses the FORTLIB functions MEMORY and LASTMEM, so it correctly deals with FORTLIB I/O buffers. This product was developed as a byproduct of work on a FORTLIB-based weapons code. MMG is available only on the Cray. It works only for codes that do not use the segmented loader, unless the end-of-memory option is not used.

59094 (UCRL—87912) **Analysis of a multigrid method as an iterative technique for solving linear systems.** Greenbaum, A. (Lawrence Livermore National Lab., CA (USA)). 18 Jun 1982. Contract W-7405-ENG-48. 27p. (CONF-8206102—1). NTIS, PC A03/MF A01. Order Number DE82018068.

From DOE NASIG meeting; Los Alamos, NM, USA (23 Jun 1982).

A general class of iterative methods is introduced for solving symmetric, positive definite linear systems. These methods use two different approximations to the inverse of the matrix of the problem, one of which involves the inverse of a smaller matrix. It is shown that the methods of this class reduce the error by a constant factor at each step and that under ideal circumstances that constant is equal to $\kappa'-1/\kappa'+1$, where κ' is the ratio of the largest eigenvalue to the (J+1)/sup st/ eigenvalue of the matrix, J being the dimension of the smaller matrix involved. A multigrid method is presented as an example of a method of this class, and it is shown that while the multigrid method does not quite achieve this optimal rate of convergence, it does reduce the error at each step by a constant factor independent of the mesh spacing h.

59095 (ZfK—433(Vol.2), pp 185-189) **Interactive language for controlling CAMAC and elementary functions using active subroutines.** Lang, I.; Turani, D. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Feb 1981. (In Russian). Dep. NTIS (US Sales Only).

From 10. international symposium nuclear electronics; Dresden, German Democratic Republic (10 Apr 1980).

The interactive language HELP developed in the Central Institute of Physics Research Budapest is a hybrid of the programming languages FOKAL and BASIC. It can be used by all the computers corresponding to the technical standards of the minicomputer type PDP-8. HELP enables controlling and performing of manifold events within the CAMAC systems. The various stages of the programming functions executed according to a strict order of priority are described in detail.

59096 **Easier way to find the sagittal depth: comments.** Brixner, B. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Applied Optics;* **21**: No. 6, 976(15 Mar 1982). Contract W-7405-ENG-36.

An easy formula for calculating both the approximate and (by iteration) the exact sagittal depth of a chord is presented. (AIP)

59097 **Integrating an array processor into a scientific computing system.** Maron, N.; Brengle, T.A. (Lawrence Livermore National Lab., CA). *Computer;* 41-44(Sep 1981). Contract W-7405-ENG-48.

There are many elements to be considered in the integration of an array processor into a scientific computing environment. Our intention here is to clarify these elements and their relationships through detailed discussions of compatibility considerations, host supervisory software operating overhead, and an example system.

59098 **Enumeration of graphical partitions.** Metropolis, N.; Stein, P.R. (Los Alamos Scientific Lab., NM). *European Journal of Combinatorics;* **1**: 139-153(1980).

The present paper greatly extends and elaborates the results of a previous paper by Stein on the enumeration of graphical partitions. The latter are a subset of partitions π 2q with exactly p nonzero parts, with q and p respectively the number of lines and points of a graph without multiple lines, loops or isolated points. The enumeration is effected in terms of an auxiliary set of partitions λ which are in 1-1 correspondence with an appropriate subclass of the partitions π. It is shown, inter alia, how Hakimi's algorithm imposes a definite recursive structure on the set [λ]. It is also shown how to write down in principle explicit enumeration formulae for any r identical with q - p.

9903 Information Handling

REFER ALSO TO CITATION(S) 57059, 58206

59099 (INIS-mf—7042) **Topics in information on nuclear science and technology: conference proceedings.** (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1980. 146p. (In Russian). (CONF-7907118—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780682.

From Conference on topics in information on nuclear science and technology; Prague, Czechoslovakia (26 Jul 1979).

The papers presented were entered in the data base separately. (WHK)

59100 (JAERI-M—9860, pp 9-20) **Nuclear energy literature published in Japan.** Narui, S.; Habara, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Dec 1981. (In Japanese). NTIS (US Sales Only), PC A04/MF A01.

In Nuclear energy information in Japan. Statistics and analysis.

The supply by Japan to INIS in 1978 were of three thousand four hundred and thirteen items. The nuclear energy literatures published in Japan, 2821 items by excluding patents and laws, consisted of 2,252 journal papers and 505 technical reports. The former were picked up from 333 journals and the latter from 23 report series of 11 organizations. Journal ranking and report contributions are tabled and figures by fields, languages and author's organizations are given in this paper.

59101 (JAERI-M—9860, pp 21-33) **Nuclear energy literature published in foreign countries.** Okumura, K.; Yamamoto, E.; Habu, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Dec 1981. (In Japanese). NTIS (US Sales Only), PC A04/MF A01.

In Nuclear energy information in Japan. Statistics and analysis.

In order to analyze nuclear energy literature of Japan published in foreign countries, 842 journal articles and 386 conference articles were extracted from 68,246 items of "INIS Atomindex 1978". The results of the survey were as follows; (1) Majority of articles were concentrated in several ten journals, such as 50% articles in 18 journals and 80% articles in 56 journals. (2) Most of 85 conferences contributed were regular meetings, and many articles were presented in several specific conferences. (3) Portion of technology in the articles were 14% in journals and 35% in proceedings.

59102 (JAERI-M—9860, pp 35-50) **Oral presentations on nuclear energy in Japan.** Habara, T.; Narui, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Dec 1981. (In Japanese). NTIS (US Sales Only), PC A04/MF A01.

In Nuclear energy information in Japan. Statistics and analysis.

Oral presentations on nuclear energy in conferences and meetings held in 1978 were surveyed. A total of 144 meetings contained 4,104 presentations on nuclear energy. Physics accounted for 44%, the highest of all presentations, followed by nuclear engineering and chemistry and materials in decreasing order. It is pointed out that, nuclear fusion comprised 21%, higher than nuclear engineering, and became an important portion of Japanese information. A further survey was then made particular with the conferences and meetings of such major societies as the Atomic Energy Society of Japan, the Physical Society of Japan, the Japan Society of Applied Physics, the Chemical Society of Japan and the Japan Health Physics Society. Also it was recognized that the oral presentations are considered as useful data sources for on-going research information.

59103 (JAERI-M—9860) **Nuclear energy information in Japan. Statistics and analysis.** Nakamoto, H. (ed.). (Japan Atomic Energy Research Inst., Tokyo). Dec 1981. 56p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780650.

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59104 (ORNL/TM—8086) **Distributed resource management: deadlocks.** Hayes, R.W. (Oak Ridge National Lab., TN (USA)). Jun 1982. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01. Order Number DE82016081.

Many applications require data base management without the need for an entire data base management system. Also, most simple locking mechanisms are not adequate for real-time data acquisition and control applications. This report presents a basic resource management mechanism which acts as a traffic cop to control access to shared data bases in a real-time system. This mechanism makes use of a deadlock avoidance algorithm to resolve allocation conflicts. The concept of resource management is developed and the problem of system deadlocking is described. Alternatives to the deadlock problem are presented for real-time systems and a modified deadlock avoidance algorithm is developed to provide efficient resource allocation. This algorithm is implemented on an RSX-11M system and is designed for easy expansion to distributed systems. A basic approach to distributed management is also presented.

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In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

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Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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AB18-80FC10120	**North Dakota Univ., Grand Forks (USA)**	
	7:56033	DOE/FC/10120—T6
AC01-76ET10237	**Institute of Gas Technology, Chicago, IL (USA)**	
	7:55979	DOE/ET/10237—1
AC01-76ET10340	**General Electric Co., Schenectady, NY (USA). Gas Turbine Div.**	
	7:56701	DOE/ET/10340—132
	7:56702	DOE/ET/10340—134
AC01-76ET12489	**Foster-Miller Associates, Inc., Waltham, MA (USA)**	
	7:56064	DOE/ET/12489—T1
AC01-78CS20468	**Starrett City Housing Corp., New York (USA)**	
	7:57266	DOE/CS/20468—T1-Vol.1
	7:57267	DOE/CS/20468—T1-Vol.2
AC01-78CS40037	**Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.**	
	7:56092	DOE/CS/40037—T13
	7:56093	DOE/CS/40037—T14
AC01-78EI08604	**Logistics Management Inst., Washington, DC (USA)**	
	7:57055	DOE/EIA/08604—T1
	7:57056	DOE/EIA/08604—T2
	7:57057	DOE/EIA/08604—T3
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AC01-78ET11056	**Polytechnic Inst. of New York, Farmingdale**	
	7:57145	Journal of Energy 6 NO. 2. 96-103 (Mar 1982).
AC01-78ET13346	**Goodman Equipment Corp., Chicago, IL (USA)**	
	7:56065	DOE/ET/13346—T61
AC01-78PE70045	**Energy and Environmental Analysis, Inc., Arlington, VA (USA)**	
	7:57296	DOE/PE/70045—T3
AC01-79CS30027	**Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.**	
	7:56604	SOLAR/0020—82/44
AC01-79ER10028	**Aerospace Corp., El Segundo, CA (USA)**	
	7:58401	DOE/ER/10028—T1
AC01-79ET21008	**Suntec Systems, Inc., St. Paul, MN (USA)**	
	7:56607	DOE/ET/21008—T1
AC01-79ET29364	**California Univ., Berkeley (USA)**	
	7:56724	CONF-820549—2
AC01-80CS50188	**Coleman and Christison, Inc., St. Paul, MN (USA)**	
	7:57211	DOE/CS/50188—T1
AC01-81EV10448	**Cv International, Inc., Torrance, CA (USA)**	
	7:57758	DOE/EV/10448—T1
AC01-81RG10071	**Gibbs and Hill, Inc., New York (USA)**	
	7:56153	DOE/RG/10071—T1
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	7:55985	DOE/METC—82-48
	7:56292	BNL-NUREG—31328
	7:56293	BNL-NUREG—31329
	7:56435	BNL—51573
	7:56584	BNL—51463
	7:56781	BNL—30756
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	7:58726	Physical Review Letters 48 NO. 20. 1385-1389 (17 May 1982).
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AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
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	7:58903	Physics of Fluids 25 NO. 9. 1564-1569 (Sep 1982).
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	7:58923	Applied Optics 21 NO. 12. 2115-2123 (15 Jun 1982).
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	7:59034	Review of Scientific Instruments 53 NO. 8. 1198-1213 (Aug 1982).
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AC02-76ER01198	**Illinois Univ., Urbana (USA)**	
	7:57476	DOE/ER/01198—1386
	7:57514	Physical Review Letters 49 NO. 1. 54-57 (5 Jul 1982).
	7:57515	Journal of Vacuum Science and Technology 21 NO. 2. 285-302 (Jul 1982).
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	7:57523	Journal of Vacuum Science and Technology 21 NO. 2. 599-606 (Jul 1982).

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	7:57794	Applied Physics Letters 41 NO. 5. 406-407 (1 Sep 1982).
AC02-76ER01763	**Ohio State Univ., Columbus**	
	7:57708	Journal of the American Chemical Society 104 NO. 7. 1842-1846 (7 Apr 1982).
AC02-76ER02220	**The Institute for Advanced Study, Princeton, New Jersey 08540**	
	7:58792	Reviews of Modern Physics 54 NO. 3. 729-766 (Jul 1982).
AC02-76ER02892	**Department of Physics, Georgia State University, Atlanta, Georgia 30303**	
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AC02-76ER03069	**Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachuse**	
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AC02-76ER03075	**Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 2074**	
	7:58793	Physical Review Letters 48 NO. 22. 1507-1510 (31 May 1982).
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AC02-76ER03130	**Fermi National Accelerator Laboratory, P. O. Box 500, Batavia, Illinois 60510**	
	7:58541	Physical Review [Section] D: Particles and Fields 26 NO. 3. 658-673 (1 Aug 1982).
AC02-76ER13001	**Department of Physics, State University of New York at Stony Brook**	
	7:58314	Astrophysical Journal 253 NO. 2. 839-841 (15 Feb 1982).
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AC02-76ET20279	**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**	
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	Massachusetts Inst. of Tech., Cambridge (USA)	
	7:56554	DOE/ET/20279—211
	Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.	
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AC02-76EV02270	**Wisconsin Univ., Madison (USA)**	
	7:58125	DOE/EV/02270—1
AC02-76EV03139	**Connecticut Univ., Storrs (USA). Dept. of Animal Genetics**	
	7:58223	DOE/EV/03139—47
	Connecticut Univ., Storrs (USA)	
	7:58247	CONF-820122—8
	Connecticut Univ., Storrs (USA). Dept. of Animal Genetics	
	7:58248	DOE/EV/03139—46
AC02-76EV03264	**Jackson Lab., Bar Harbor, ME (USA)**	
	7:58220	DOE/EV/03264—21
AC02-76EV03425	**Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (Germany, F.R.). Inst. fuer Atmosphaerische Umweltforschung**	
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AC02-76EV03490	**Univ. of Rochester, NY**	
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AC02-76EV04018	**Colorado State Univ., Fort Collins (USA). Dept. of Range Science**	
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AC02-77CH00178	**Solar Energy Research Inst., Golden, CO (USA)**	
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	7:56473	SERI/TP—215-1636
	7:56524	SERI/TR—9010-3-T1
	7:56525	SERI/TR—9079-1-T7
	7:56526	SERI/TR—19451-1
	7:56613	SERI/TP—255-1408
	7:56679	SERI/PR—211-1672
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AC02-77EV04533	**Cincinnati Univ., OH (USA)**	
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AC02-77EV04552	**Univ. of Pittsburg, PA**	
	7:58264	Advance Data from Vital and Health Statistics NO. 76. 1-24 (17 Mar 1982).
AC02-78ER04679	**Illinois Univ., Urbana (USA)**	
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AC02-78ER05007	**Department of Physics, George Mason University, Fairfax, Virginia 22030**	
	7:58307	Physical Review [Section] D: Particles and Fields 26 NO. 1. 336-339 (1 Jul 1982).
AC02-78ER05015	**Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science**	
	7:57688	DOE/ER/05015—4-Pt.1
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AC02-78ER05031	**Amherst Coll., MA (USA)**	
	7:57578	DOE/ER/05031—4
AC02-78ET51013	**Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center**	
	7:58966	DOE/ET/51013—25
AC02-79CS30150	**Mid-American Solar Energy Complex, Minneapolis, MN (USA)**	
	7:57130	MASEC-CF—81-096
AC02-79CS30166	**Southern Solar Energy Center, Atlanta, GA (USA)**	
	7:56490	DOE/CS/30166—T58
AC02-79CS30238	**Georgia Inst. of Tech., Atlanta (USA). Coll. of Architecture**	
	7:56585	CONF-811109—5
AC02-79ER10353	**McDonnell Center for the Space Sciences and Department of Physics, Washington University, St. Louis,**	
	7:58384	Physical Review Letters 48 NO. 24. 1675-1677 (14 Jun 1982).
AC02-79ER10412	**State Univ. of New York, Stony Brook (USA). Dept. of Earth and Space Sciences**	
	7:58283	DOE/ER/10412—T1
AC02-79ER10462	**Department of Physics, University of Missouri—Kansas City, Kansas City, Missouri 64110**	
	7:57517	Journal of Vacuum Science and Technology 21 NO. 2. 398-401 (Jul 1982).
AC02-80ER10556	**Brown Univ., Providence, RI (USA). Div. of Engineering**	
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AC02-80ER10663	**Physics Department, University of Arizona, Tucson, Arizona 85721**	
	7:58543	Physical Review [Section] D: Particles and Fields 26 NO. 1. 239-247 (1 Jul 1982).
AC02-80ER10677	**Kansas State University, Manhattan, Kansas 66506**	
	7:57564	Applied Optics 21 NO. 6. 976-977 (15 Mar 1982).
AC02-80ER10689	**Purdue Univ., West Lafayette, IN**	
	7:57677	Journal of the American Chemical Society 104 NO. 8. 2320-2321 (21 Apr 1982).
AC02-80ER10773	**Physics Department, Stanford University, Stanford, California 94305**	
	7:58309	Physical Review Letters 48 NO. 23. 1636-1640 (7 Jun 1982).
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AC02-80ET26225	**General Atomic Co., San Diego, CA**	
	7:56438	International Journal of Hydrogen Energy 7 NO. 5. 381-392 (1982).
AC02-80EV10360	**Chicago Univ., IL (USA)**	
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AC02-80EV10417	**New York Medical Coll., Valhalla (USA). Dept. of Microbiology**	
	7:58230	DOE/EV/10417—2
AC02-81ER10972	**Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering**	
	7:57319	DOE/ER/10972—T1
AC02-81ER40001	**Wisconsin Univ., Madison (USA)**	
	7:58342	DOE/ER/40001—33
AC03-76ER00068	**California Institute of Technology, Pasadena, California 91125**	
	7:58796	Reviews of Modern Physics 54 NO. 2. 407-435 (Apr 1982).
AC03-76ET53057	**Plasma Research Institute, Science Applications Inc., Boulder Colorado 80302**	
	7:58901	Physics of Fluids 25 NO. 9. 1491-1492 (Sep 1982).
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AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
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	7:57182	LBL-PUB—448
	7:57366	LBL—14664
	7:57367	LBL—14668
	7:57556	LBL—13867
	7:57699	LBL—14673
	7:58015	Applied Physics Letters 41 NO. 4. 315-317 (15 Aug 1982).
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	7:58379	Physical Review Letters 49 NO. 1. 76-79 (5 Jul 1982).
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AC03-76SF00472	**California Univ., Davis (USA). Lab. for Energy-Related Health Research**	
	7:58219	UCD—472-504
AC03-76SF00515	**Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305**	
	7:57508	Journal of Applied Physics 53 NO. 8. 5447-5452 (Aug 1982).
	7:58529	Physical Review Letters 48 NO. 24. 1657-1659 (14 Jun 1982).
	7:58575	Physical Review [Section] D: Particles and Fields 26 NO. 2. 455-467 (15 Jul 1982).
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AC03-76SF01035	**Aerojet Mfg. Co., Fullerton, CA (USA)**	
	7:56782	DOE/SF/01035—T2
AC03-77ET13108	**Gulf Research and Development Co., Pittsburgh, PA (USA)**	
	7:55984	DOE/ET/13108—81
AC03-78ET27145	**Tennessee Univ., Knoxville (USA). Dept. of Chemical, Metallurgical and Polymer Engineering**	
	7:56644	DOE/ET/27145—2
AC03-78SF02034	**Gas-Cooled Reactor Associates, La Jolla, CA (USA)**	
	7:56769	DOE/SF/02034—T66
	United Engineers and Constructors, Inc., Philadelphia, PA (USA)	
	7:56770	DOE/SF/02034—T75
	Gas-Cooled Reactor Associates, La Jolla, CA (USA)	
	7:56913	DOE/SF/02034—T44Vol.2
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	7:56915	DOE/SF/02034—T78
	7:56918	DOE/SF/02034—T64
AC03-79CS40213	**Beet Sugar Development Foundation, Fort Collins, CO (USA)**	
	7:56488	BSDF—39-8Q-81
AC03-80ET34034	**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**	
	7:56912	DOE/ET/34034—T12
AC03-81SF11514	**Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.**	
	7:56474	ATR—82-7981-02-1
AC04-76-DP00613	**Bendix Corp., Kansas City, MO (USA)**	
	7:57755	BDX—613-2775
AC04-76DP00053	**Monsanto Research Corp., Miamisburg, OH (USA)**	
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	Mound Facility, Miamisburg, OH (USA)	
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AC04-76DP00613	**Bendix Corp., Kansas City, MO (USA)**	
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	7:58006	BDX—613-2658R
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AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	7:56378	NUREG/CR—1636-Vol.1
	7:56379	NUREG/CR—1636-Vol.2
	7:56380	NUREG/CR—1636-Vol.3
	Barry (Theodore) and Associates, Los Angeles, CA (USA)	
	7:56477	SAND—81-7047
	Sandia National Labs., Albuquerque, NM (USA)	
	7:56478	SAND—82-8030
	7:56518	SAND—81-1406
	General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.	
	7:56519	SAND—81-7007
	Sandia National Labs., Albuquerque, NM (USA)	
	7:56520	SAND—81-7009
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	7:56522	SAND—82-7105
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	T.E.A., Inc., Harrisville, NH (USA)	
	7:56558	SAND—81-7019/1
	Sandia National Labs., Albuquerque, NM (USA)	
	7:56559	SAND—81-7085/8
	Boeing Computer Services Co., Seattle, WA (USA)	
	7:56560	SAND—81-7085/10
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	Sandia National Labs., Albuquerque, NM (USA)	
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	Boeing Computer Services Co., Seattle, WA (USA)	
	7:56563	SAND—81-7088/7
	Sandia National Labs., Albuquerque, NM (USA)	
	7:56564	SAND—81-7099/6
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	7:56566	SAND—82-7075C
	BDM Corp., Albuquerque, NM (USA)	
	7:56567	SAND—82-7118
	Sandia National Labs., Livermore, CA (USA)	
	7:56572	SAND—81-1780
	7:56573	SAND—82-8220
	Sandia National Labs., Albuquerque, NM (USA)	
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	7:56693	SAND—82-0672
	7:57017	SAND—82-1833C
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	Sandia National Labs., Livermore, CA (USA)	
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	Sandia National Labs., Albuquerque, NM (USA)	
	7:57456	SAND—81-2454C
	7:57469	SAND—82-1259
	7:57504	Applied Physics Letters 41 NO. 4. 335-337 (15 Aug 1982).
	7:57512	Journal of Applied Physics 53 NO. 8. 5968-5971 (Aug 1982).
	7:57518	Journal of Vacuum Science and Technology 21 NO. 2. 469-472 (Jul 1982).
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	7:57830	SAND—81-2489
	7:57842	SAND—82-0963
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	Sandia Labs., Albuquerque, NM (USA)	
	7:58004	AD-A—111047/7
	Sandia National Labs., Albuquerque, NM (USA)	
	7:58005	SAND—81-2140
	7:58016	Applied Physics Letters 41 NO. 4. 324-326 (15 Aug 1982).
	7:58019	Journal of Applied Physics 53 NO. 8. 5964-5965 (Aug 1982).
	7:58026	SAND—82-0831
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	7:59032	Physics of Fluids 25 NO. 8. 1471-1479 (Aug 1982).
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AC04-76DP03533	**Kaman Aerospace Corp., Bloomfield, CT (USA)**	
	7:56690	RFP—3302/2-Vol.2
	McDonnell Aircraft Co., St. Louis, MO (USA)	
	7:56691	RFP—3304
	North Wind Power Co., Warren, VT (USA)	
	7:56692	RFP—3310/2
	Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant	
	7:57723	RFP—3113
AC04-79ET23001	**Center for Theoretical Physics, Laboratory for Nuclear Science and ment of Physics**	
	7:58728	Physical Review [Section] C: Nuclear Physics 25 NO. 5. 2196-2213 (May 1982).
AC05-76OR00001	**Goodyear Atomic Corp., Piketon, OH (USA)**	
	7:56710	GAT-S—24/Rev.1
AC05-78ET20154	**TRW Energy Systems Planning Div., McLean, VA (USA)**	
	7:56475	DOE/ET/20154—T3
AC05-78OR03054	**International Coal Refining Co., Allentown, PA (USA)**	
	7:55986	DOE/OR/03054—6
AC05-82OR20900	**Massachusetts Inst. of Tech., Cambridge (USA)**	
	7:56253	UVA-ER—746-82U
AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
	7:58963	DOE/ER—0046/7
AC06-76RL01830	**Pacific Northwest Lab., Richland, WA (USA)**	
	7:56267	PNL—4116
	7:56281	PNL-SA—10385-A
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	7:56414	PNL—3852
	Battelle Pacific Northwest Labs., Richland, WA (USA)	
	7:56517	PNL—3970
	Pacific Northwest Lab., Richland, WA (USA)	
	7:56571	PNL—4003
	Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.	
	7:56609	PNL—4257
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	Pacific Northwest Lab., Richland, WA (USA)	
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	7:57087	PNL—3570
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AC06-76RL01857	**UNC Nuclear Industries, Inc., Richland, WA (USA)**	
	7:56953	UNI-TR—8
AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
	7:56330	RHO-BWI-C—105
	Rockwell International Corp., Richland, WA (USA). Energy Systems Group	
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	Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations	
	7:56332	RHO-LD—175
	7:58119	RHO-LD—163
	7:58180	RHO-BWI-LD—33

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AC06-79ET23112	**Simpson Weather Associates, Charlottesville, VA (USA)**	
	7:56589	DOE/ET/23112—1
AC06-79ET23164	**Colorado State Univ., Fort Collins (USA). Dept. of Mechanical Engineering**	
	7:56685	DOE/ET/23164—1
AC06-81ER40048	**Washington Univ., Seattle (USA). Dept. of Physics**	
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AC07-79ID12079	**Utah Univ., Salt Lake City (USA). Research Inst.**	
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AC13-76GJ01664	**Bendix Field Engineering Corp., Grand Junction, CO (USA)**	
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82-7981-02-1	NTIS, PC A03/MF A01	DE82016190	MN -62	7:56474
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30609	NTIS, PC A02/MF A01	DE82006935	MN -32	7:59075
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5101	NTIS (US Sales Only), MF A0106/MF A01	DE82702349	MN -25	7:57315
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5139	NTIS (US Sales Only), MF A0111/MF A01	DE82701970	MN -34A	7:56257
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24	NTIS (US Sales Only), MF A0103/MF A01	DE82903167	MN -34C	7:58687
CONF-810948-	(Actinides-1981 conference, Pacific Grove, CA, USA, 10-15 Sep 1981)			
4	*See* CEA-CONF-5916	DE82701969	MN -34A	7:57475
5	*See* CEA-CONF-5992	DE82702341	MN -86	7:56264
CONF-8109140-	(5. French symposium on mechanics, Marseille, France, 7-11 Sep 1981)			
1(Summ.)	*See* CEA-CONF-5986	DE82702253	MN -34A	7:58400
CONF-8109141-	(Summer school of electron microscopy in material sciences, Bombannes, France, 21 Sep-3 Oct 1981)			
1	*See* CEA-CONF-5999	DE82702254	MN -34A	7:58752
2	*See* CEA-CONF-6000	DE82702255	MN -34A	7:58340
CONF-8109142-	(International symposium on clustering phenomena in nuclei, Tuebingen, F.R. Germany, 9-11 Sep 1981)			
1	*See* CEA-CONF-5930	DE82702305	MN -34C	7:58711
CONF-8109144-	(6. international seminar on high energy physics problems: multiquark interactions and quantum chromodynamics, Dubne, USSR, 15-19 Sep 1981)			
1	*See* CEA-CONF-6003	DE82702307	MN -34D	7:58447
CONF-8109145-	(CNRS international symposium on chemistry and physics of sulfides, selenides and tellurides in the solid state, Paris, France, 14-17 Sep 1981)			
1	*See* CEA-CONF-5904	DE82702338	MN -4	7:57712
CONF-8109158-	(7. international conference on powder metallurgy, Dresden, German Democratic Republic, 22-24 Sep 1981)			
Pt.1-Summ.	*See* INIS-mf-7095	DE82780702	MN -25	7:57300
Pt.2-Summ.	*See* INIS-mf-7096	DE82780701	MN -25	7:57301
Pt.3-Summ.	*See* INIS-mf-7097	DE82780703	MN -25	7:57302
CONF-8109168-	(12. Mendeleev's conference on general and applied chemistry, Baku, USSR, 21-26 Sep 1981)			
Vol.7-Summ.	*See* INIS-SU-111	DE82780731	MN -4	7:57538
CONF-8109169-	(5. international symposium on water column separation, Obernach, F.R. Germany, 28-30 Sep 1981)			
	See CISE-1724			7:56700
CONF-811012-	(IEEE symposium on nuclear science, San Francisco, CA, USA, 21-23 Oct 1981)			
50	*See* EGG-M-01781	DE82007336	MN -70	7:56302
CONF-811015-	(Geothermal Resources Council annual meeting, Houston, TX, USA, 25-29 Oct 1981)			
22	*See* EGG-M-05481-C	DE82005682	MN -66	7:56671
CONF-811025-	(25. conference on analytical chemistry and nuclear technology, Gatlinburg, TN, USA, 6 Oct 1981)			
26	*See* DPSPU-81-30-9	DE82020068	MN -37	7:58008
CONF-811028-	(23. annual meeting of the division of plasma physics of the APS, New York, NY, USA, 12-16 Oct 1981)			
14	*See* CEA-CONF-6066	DE82702259	MN -20	7:58961
CONF-811040-	(9. symposium on engineering problems of fusion research, Chicago, IL, USA, 26-29 Oct 1981)			
146	*See* UCRL-86029	DE82006772	MN -21	7:59024

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CONF-811046-	(Meeting and workshop on fusion reactor design and technology, Tokyo, Japan, 5-16 Oct 1981)			
15	*See* DOE/ET/51013-25	DE82007365	STD -20d	7:58966
CONF-811056-	(Seminar on the management of radioactive waste from nuclear power plants, Karlsruhe, F.R. Germany, 5-9 Oct 1981)			
2	*See* EGG-M-08181	DE82007337	MN -78	7:56959
6	*See* CEA-CONF-6054	DE82702203	MN -70	7:56294
CONF-811069-	(International conference on production, fabrication, properties, and application of ferritic steels for high-temperature applications, Warren, PA, USA, 6-8 Oct 1981)			
4	*See* CEA-CONF-6061	DE82702347	MN -25	7:57314
CONF-8110152-	(AIP conference on pion production and absorption in nuclei, Bloomington, IN, USA, 22-24 Oct 1981)			
	AIP Conf. Proc., 79: No. 1, 297-317(10 Mar 1982)			7:58630
CONF-8110184-	(7. European meeting on diagraphy, Paris, France, 21-23 Oct 1981)			
1	*See* CEA-CONF-6069	DE82702335	MN -51	7:57542
CONF-8110222-	(Symposium and banquet speeches of the celebration of the 50th anniversary of Lawrence Berkeley Laboratory, Berkeley, CA, USA, 3 Oct 1981)			
	See LBL-13613	DE82013635	STD -2	7:59074
CONF-811103-	(ANS winter meeting, San Francisco, CA, USA, 29 Nov-4 Dec 1981)			
	Trans. Am. Nucl. Soc., 39: 201(1981)			7:56254
	Trans. Am. Nucl. Soc., 39: 215-217(1981)			7:56262
	Trans. Am. Nucl. Soc., 39: 323-326(1981)			7:56263
	Trans. Am. Nucl. Soc., 39: 172(1981)			7:56270
	Trans. Am. Nucl. Soc., 39: 219(1981)			7:56271
	Trans. Am. Nucl. Soc., 39: 219-220(1981)			7:56272
	Trans. Am. Nucl. Soc., 39: 536-537(1981)			7:56273
	Trans. Am. Nucl. Soc., 39: 187-189(1981)			7:56286
	Trans. Am. Nucl. Soc., 39: 189-190(1981)			7:56287
	Trans. Am. Nucl. Soc., 39: 192(1981)			7:56288
	Trans. Am. Nucl. Soc., 39: 226-227(1981)			7:56289
	Trans. Am. Nucl. Soc., 39: 149-150(1981)			7:56351
	Trans. Am. Nucl. Soc., 39: 165-166(1981)			7:56352
	Trans. Am. Nucl. Soc., 39: 171(1981)			7:56353
	Trans. Am. Nucl. Soc., 39: 173-174(1981)			7:56354
	Trans. Am. Nucl. Soc., 39: 179-180(1981)			7:56355
	Trans. Am. Nucl. Soc., 39: 207-208(1981)			7:56356
	Trans. Am. Nucl. Soc., 39: 208-209(1981)			7:56357
	Trans. Am. Nucl. Soc., 39: 211-212(1981)			7:56358
	Trans. Am. Nucl. Soc., 39: 212-214(1981)			7:56359
	Trans. Am. Nucl. Soc., 39: 224-225(1981)			7:56360
	Trans. Am. Nucl. Soc., 39: 225-226(1981)			7:56361
	Trans. Am. Nucl. Soc., 39: 228(1981)			7:56362
	Trans. Am. Nucl. Soc., 39: 228-229(1981)			7:56363
	Trans. Am. Nucl. Soc., 39: 229-231(1981)			7:56364
	Trans. Am. Nucl. Soc., 39: 220-221(1981)			7:56418
	Trans. Am. Nucl. Soc., 39: 306-307(1981)			7:56419
	Trans. Am. Nucl. Soc., 39: 313-314(1981)			7:56420
	Trans. Am. Nucl. Soc., 39: 316-317(1981)			7:56421
	Trans. Am. Nucl. Soc., 39: 319-320(1981)			7:56422
	Trans. Am. Nucl. Soc., 39: 322-323(1981)			7:56423
	Trans. Am. Nucl. Soc., 39: 266-268(1981)			7:56427
	Trans. Am. Nucl. Soc., 39: 243-244(1981)			7:58936
	Trans. Am. Nucl. Soc., 39: 245-246(1981)			7:58937
	Trans. Am. Nucl. Soc., 39: 235(1981)			7:59042
	Trans. Am. Nucl. Soc., 39: 235-236(1981)			7:59043
	Trans. Am. Nucl. Soc., 39: 236-238(1981)			7:59044
	Trans. Am. Nucl. Soc., 39: 242-243(1981)			7:59045
	Trans. Am. Nucl. Soc., 39: 246-247(1981)			7:59046
	Trans. Am. Nucl. Soc., 39: 251-253(1981)			7:59047
	Trans. Am. Nucl. Soc., 39: 255-257(1981)			7:59048
	Trans. Am. Nucl. Soc., 39: 259-260(1981)			7:59049
	Trans. Am. Nucl. Soc., 39: 260-261(1981)			7:59050
	Trans. Am. Nucl. Soc., 39: 261(1981)			7:59051
	Trans. Am. Nucl. Soc., 39: 265-266(1981)			7:59052
	Trans. Am. Nucl. Soc., 39: 270-271(1981)			7:59053
	Trans. Am. Nucl. Soc., 39: 271-272(1981)			7:59054
	Trans. Am. Nucl. Soc., 39: 272-274(1981)			7:59055
CONF-811109-	(1981 international passive and hybrid cooling conference, Miami Beach, FL, USA, 11-13 Nov 1981)			
5	NTIS, PC A02/MF A01	DE82016231	MN -95d	7:56585
CONF-811113-	(American Vacuum Society national symposium, Anaheim, CA, USA, 3-6 Nov 1981)			
45	NTIS, PC A02/MF A01	DE82004062	MN -20a	7:58821
52	*See* CEA-CONF-6075	DE82702260	MN -21	7:56424
CONF-811156-	(Symposium on genetic toxicology: an agricultural perspective, Davis, CA, USA, 1-5 Nov 1981)			
2	*See* UCRL-87003	DE82006744	MN -41	7:58263
CONF-811174-	(2. convention of the international colloquium on drops and bubbles, Monterey, CA, USA, 19-21 Nov 1981)			
	See NASA-CR-168848			7:59014

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CONF-811231-	(Forward collider workshop, Madison, WI, USA, 10-12 Dec 1981)			
	American Institute of Physics, 335 E. 45th Street, New York, NY 10017			7:58414
CONF-811248-	(Conference on monopoles in quantum field theory, Trieste, Italy, 11-15 Dec 1981)			
1	*See* NBI-HE-82-1	DE82702247	MN -34D	7:58566
CONF-811251-	(Coal and biomass: the role of synfuels conference, Chicago, IL, USA, 9-10 Dec 1981)			
Summ.	*See* DOE/ER/10206-1	DE82014680	MN -13	7:57110
CONF-811257-	(Workshop on environmental assessment, Gaithersburg, MD, USA, 15-18 Dec 1981)			
	See NUREG/CP-0025		MN -11	7:58166
CONF-820122-	(Symposium on the application of short-term bioassays in the analysis of complex environmental mixtures, Chapel Hill, NC, USA, 25-27 Jan 1982)			
8	NTIS, PC A02/MF A01	DE82020382	MN -48	7:58247
CONF-820134-	(IEEE Power Engineering Society winter meeting, New York, NY, USA, 30 Jan-4 Feb 1982)			
2	*See* SAND-82-7075C	DE82019344	MN -63	7:56566
CONF-820251-	(9. AINSE nuclear physics conference, Melbourne, Australia, 8-10 Feb 1982)			
Absts.	*See* INIS-mf-7116	DE82780693	MN -34D	7:58591
CONF-820256-	(Electron beam workshop, Arlington, VA, USA, 25-26 Feb 1982)			
1	NTIS, PC A02/MF A01	DE82019410	MN -90i	7:57843
CONF-820307-	(Topical meeting on engineering for nuclear plant construction, operation, and maintenance, Charleston, SC, USA, 28-31 Mar 1982)			
	Trans. Am. Nucl. Soc., Suppl., 41: 66(1982)			7:56909
CONF-820338-	(Symposium on accelerator aspects of ion fusion, Darmstadt, F.R. Germany, 29 Mar-2 Apr 1982)			
8	*See* LA-UR-82-1192	DE82015769	MN -21	7:59011
CONF-820377-	(Gas Research Institute workshop on fire and radiation, Boston, MA, USA, 21 Mar 1982)			
1	*See* UCRL-87667	DE82015921	MN -11	7:56183
CONF-820385-	(International school of nuclear physics conference, Trapain, Sicily, Italy, 27 Mar-8 Apr 1982)			
1	*See* BNL-31486	DE82018062	MN -34C	7:58710
CONF-820386-	(NERA seminar cogeneration: making it happen, New York, NY, USA, 18 Mar 1982)			
Summ.	NTIS, PC A02/MF A01	DE82905228	MN -95a	7:57088
CONF-820412-	(Metallurgical coatings and process technology conference, San Diego, CA, USA, 4-9 Apr 1982)			
4	*See* SAND-81-2454C	DE82015412	MN -25	7:57456
CONF-820418-	(UCC-ND and GAT environmental protection seminar, Gatlinburg, TN, USA, 5-7 Apr 1982)			
7Rev.1	*See* GAT-S-24/Rev.1	DE82014824	MN -90i	7:56710
CONF-820424-	(ANS topical meeting on treatment and handling of radioactive wastes, Richland, WA, USA, 19-22 Apr 1982)			
21	*See* PNL-SA-10261	DE82014847	MN -70	7:56324
22	*See* PNL-SA-10269	DE82014856	MN -70	7:56325
23	*See* PNL-SA-10365	DE82014855	MN -70	7:56328
CONF-820449-	(63. annual meeting of the American Welding Society, Kansas City, MO, USA, 26-30 Apr 1982)			
2	*See* DPSPU-81-30-18	DE82020098	MN -38	7:56430
CONF-820458-	(Conference on health issues related to metal and nonmetallic mining, Park City, UT, USA, 7-9 Apr 1982)			
1	*See* LA-UR-82-1284	DE82015743	MN -91	7:56207
CONF-820459-	(Beryllium subwog meeting, Denver, CO, USA, 19-20 Apr 1982)			
1	*See* LA-UR-82-1363	DE82016072	MN -22	7:58074
2	*See* UCRL-87370	DE82019433	MN -25	7:57379
CONF-820547-	(84. annual meeting of the American Ceramic Society, Cincinnati, OH, USA, 2-5 May 1982)			
11	*See* PNL-SA-10004	DE82014858	MN -70	7:57499
CONF-820549-	(International symposium on circuits and systems, Rome, Italy, 10-12 May 1982)			
2	NTIS, PC A02/MF A01	DE82015636	MN -97c	7:56724
CONF-820557-	(American Gas Association transmission conference, Chicago, IL, USA, 17-19 May 1982)			
2	NTIS, PC A02/MF A01	DE82016221	MN -90c	7:55977
CONF-820566-	(Thermal reactor benchmark calculations, techniques, results and applications seminar, Upton, NY, USA, 17-18 May 1982)			
1	NTIS, PC AA02/MF A01	DE82015685	MN -32	7:58751
CONF-8205102-	(Workshop on quark matter formation and heavy ion collisions, Bielefeld, F.R. Germany, 10-14 May 1982)			
3	*See* LBL-14513	DE82020128	MN -34D	7:58300
CONF-8205113-	(Symposium on plasma double layers, Roskilde, Denmark, 1 May 1982)			
1	*See* LA-UR-82-2262	DE82019536	MN -34B	7:58886
CONF-8205114-	(American Chemical Society symposium on inorganic chemistry, Bloomington, IN, USA, 16-19 May 1982)			
1	*See* BNL-31632	DE82019530	MN -21	7:57577

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CONF-820609-	(American Nuclear Society annual meeting, Los Angeles, CA, USA, 6-11 Jun 1982)			
31	*See* LA-UR-82-1425	DE82015729	MN -37	7:58010
74	*See* BNL-30756	DE82019525	MN -79a	7:56781
75	*See* UCRL-87091	DE82020173	MN -70	7:56337
CONF-820610-	(American Institute of Chemical Engineers' spring meeting, Anaheim, CA, USA, 8-10 Jun 1982)			
7	*See* UCRL-87650	DE82015759	MN -11	7:58162
8	*See* UCRL-87662	DE82015508	MN -90c	7:56014
CONF-820612-	(Symposium on instrumentation and control for fossil energy processes, Houston, TX, USA, 7-9 Jun 1982)			
2	*See* MLM-2951(OP)	DE82015843	MN -90c	7:56003
9	*See* LBL-13867	DE82020123	MN -37	7:57556
CONF-820614-	(9. US national congress of applied mechanics, Ithace, NY, USA, 21-25 Jun 1982)			
2	*See* LA-UR-82-1291	DE82015811	MN -34	7:57814
CONF-820638-	(5. international meeting of modern ceramics technologies, Lignano-Sabbiadoro, Italy, 14-19 Jun 1982)			
2-Rev.	*See* LBL-12849-Rev.	DE82015750	MN -25	7:57498
CONF-820641-	(Workshop on Precision Machining Society of manufacturing engineers, St Paul, MN, USA, 6-8 Jun 1982)			
2	*See* Y/DX-423	DE82019811	MN -38	7:57764
CONF-820642-	(JOWOG-28 meeting, Kansas City, MO, USA, 10-11 Jun 1982)			
1	*See* UCRL-87584	DE82015191	MN -25	7:57470
CONF-820645-	(12. symposium on engineering aspects of magnetohydrodynamics, Los Angeles, CA, USA, 14-16 Jun 1982)			
3	*See* DOE/NASA/10769-26	DE82017569	STD -90g	7:57141
CONF-820650-	(3. Japan/US HTGR safety technology seminar, Upton, NY, USA, 2-3 Jun 1982)			
7	*See* LA-UR-82-1920	DE82019573	MN -77	7:56773
CONF-820655-	(Health Physics Society annual meeting, Las Vegas, NV, USA, 27 Jun-1 Jul 1982)			
8	*See* DPSPU-81-30-14	DE82020095	MN -37	7:57977
CONF-820664-	(ASHRAE national meeting, Toronto, Ontario, Canada, 27 Jun-1 Jul 1982)			
9	NTIS, PC A02/MF A01	DE82018264	MN -95d	7:57174
CONF-8206101-	(Conference on pulsations in classical and cataclysmic variable stars, Boulder, CO, USA, 1 Jun 1982)			
1	*See* LA-UR-82-1945	DE82019569	MN -34B	7:58299
CONF-8206102-	(DOE NASIG meeting, Los Alamos, NM, USA, 23-25 Jun 1982)			
1	*See* UCRL-87912	DE82018068	MN -34	7:59094
CONF-8206103-	(4. international conference on international energy issues, Cambridge, UK, 28-30 Jun 1982)			
1	*See* PNL-SA-10310	DE82019204	MN -16	7:56327
CONF-8206104-	(CEC specialists meeting - methods of krypton-85 management, Brussels, Belgium, 29 Jun 1982)			
1	*See* PNL-SA-10536	DE82019206	MN -70	7:56329
CONF-8206105-	(IEEE conference, Oxford, UK, 28-30 Jun 1982)			
1	*See* LA-UR-82-2039	DE82019562	MN -90j	7:56109
CONF-8206106-	(14. conference on nuclear safety, Tokyo, Japan, 4 Jun 1982)			
1	*See* BNL-NUREG-31329		MN -70	7:56293
2	*See* BNL-NUREG-31328		MN -70	7:56292
CONF-8206107-	(18. Alfred Benzon symposium - haemopoietic stem cells, Copenhagen, Denmark, 13-17 Jun 1982)			
2	*See* BNL-31593	DE82020033	MN -48	7:58222
CONF-820704-	(International topical meeting on LMFBR safety, Lyon, France, 18-23 Jul 1982)			
19	*See* LA-UR-82-1948	DE82019556	MN -79p	7:56966
20	*See* LA-UR-82-1947	DE82019567	MN -79p	7:56965
21	*See* LA-UR-82-1946	DE82019568	MN -79p	7:56964
CONF-820707-	(International conference on soil dynamics and earthquake engineering, Southampton, UK, 13-15 Jul 1982)			
1	*See* UCRL-86217	DE82009014	MN -80	7:58127
CONF-820710-	(8. international pyrotechnics symposium, Steamboat Springs, CO, USA, 12-16 Jul 1982)			
6	*See* SAND-82-0198C	DE82015262	MN -38	7:58028
CONF-820712-	(Annual heavy oil slush EOR contractors conference, San Francisco, CA, USA, 27-29 Jul 1982)			
	NTIS, PC A11/MF A01	DE82019821	STD -92a	7:56121
CONF-820713-	(Institute of Nuclear Materials meeting, Washington, DC, USA, 19-21 Jul 1982)			
27	*See* AGNS-35900-CONF-171	DE82019992	MN -83	7:56392
CONF-820729-	(Summer computer simulation conference, Denver, CO, USA, 19-21 Jul 1982)			
1	NTIS, PC A02/MF A01	DE82018164	MN -11	7:58131
CONF-820730-	(TVA southeast region biomass research conference, Muscle Shoals, AL, USA, 12-13 Jul 1982)			
1	NTIS, PC A02/MF A01	DE82018169	MN -61a	7:56489

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CONF-820731-	(North Atlantic Treaty Organization Advanced Study Institute conference on atomic and molecular processes in controlled thermonuclear research, Palermo, Italy, 19-30 Jul 1982)			
1	*See* UCRL-87779	DE82019313	MN -34A	7:59027
CONF-820732-	(International union of pure and applied physics conference, Boulder, CO, USA, 12-16 Jul 1982)			
1	*See* UCRL-87803	DE82019117	MN -34	7:59028
CONF-820733-	(Designing and managing energy conscious commercial buildings conference, Denver, CO, USA, 19-20 Jul 1982)			
1	*See* LA-UR-82-2040	DE82019561	MN -59c	7:56592
CONF-820734-	(Workshop on remote detection of hazardous materials, Gaithersburg, MD, USA, 21 Jul 1982)			
1	*See* LA-UR-82-1929	DE82019571	MN -34	7:57555
CONF-820735-	(IEEE Power Engineering society summer meeting, San Francisco, CA, USA, 18-23 Jul 1982)			
1	NTIS, PC A02/MF A01	DE82018258	MN -97b	7:56725
2	NTIS, PC A02/MF A01	DE82018257	MN -63	7:56549
CONF-820736-	(17. annual European Society for Radiation Biology meeting on effects of prenatal irradiation, Bordeaux, France, 26-29 Jul 1982)			
1	*See* BNL-31581	DE82018100	MN -48	7:58227
CONF-820738-	(INS symposium on dynamics of nuclear collective motion, Mount Fuji, Japan, 6-10 Jul 1982)			
1	NTIS, PC A02/MF A01	DE82018159	MN -34C	7:58680
CONF-820740-	(SIAM 30th annuversary meeting, Stanford, CA, USA, 19-23 Jul 1982)			
1	NTIS, PC A03/MF A01	DE82018261	MN -32	7:59079
CONF-820742-	(13. international symposium on rarefied gas dynamics, Novosibirsk, USSR, 5-9 Jul 1982)			
1	*See* BNL-31561	DE82019527	MN -34	7:58339
CONF-820745-	(2. LAMPF workshop, Los Alamos, NM, USA, 19-22 Jul 1982)			
1	*See* BNL-31674	DE82020376	MN -34D	7:58606
CONF-820801-	(19. international symposium on combustion, Haifa, Israel, 8-13 Aug 1982)			
	See CFD-82/2			7:56191
12	*See* BNL-31559	DE82019526	MN -4	7:57687
CONF-820805-	(AIAA atmospheric flight mechanics conference, San Diego, CA, USA, 9-11 Aug 1982)			
2	*See* SAND-82-0666C	DE82020037	MN -33	7:57816
3	*See* SAND-82-0526C	DE82020036	MN -33	7:57815
CONF-820820-	(Review of progress in quantitative NDE, San Diego, CA, USA, 1-6 Aug 1982)			
2	*See* Y/DW-361	DE82019419	MN -25	7:57380
CONF-820822-	(26. technical symposium and exhibition of the International Society for Optical Engineering, San Diego, CA, USA, 21-27 Aug 1982)			
8	*See* UCRL-87284	DE82019437	MN -37	7:58048
CONF-820827-	(Energy storage contractors review meeting, Arlington, VA, USA, 23-26 Aug 1982)			
5	*See* SAND-82-1833C	DE82020088	MN -94a	7:57017
CONF-820833-	(17. DOE nuclear air cleaning conference, Denver, CO, USA, 1 Aug-6 Sep 1982)			
7	*See* BNL-NUREG-31557	DE82019448	MN -77	7:56955
8	*See* K/PS-5002	DE82019469	MN -86	7:56306
CONF-820834-	(3. AAPG circum-Pacific Energy and Materials conference, Honolulu, HI, USA, 22-28 Aug 1982)			
2	*See* LA-UR-82-1971	DE82019554	MN -66b	7:56654
CONF-820837-	(American Fisheries Society symposium on aquisition and utilization of aquatic habitat inventory information, Billings, MT, USA, 1 Aug 1982)			
1	*See* PNL-SA-9978	DE82019213	MN -11	7:58173
CONF-820838-	(Future engineering development needs for magnetic fusion workshop, Washington, DC, USA, 3-4 Aug 1982)			
1	*See* LA-UR-82-1973	DE82019566	MN -20d	7:59012
2	*See* UCRL-87749	DE82019434	MN -20	7:59026
CONF-820839-	(International conference on X-ray and VUV synchrotron radiation instrumentation, Hamburg, F.R. Germany, 9-13 Aug 1982)			
1	*See* BNL-31570	DE82018059	MN -28	7:57913
CONF-820840-	(8. underground coal conversion symposium, Keystone, CO, USA, 15-19 Aug 1982)			
3-Rev.1	*See* UCRL-87611-Rev.1	DE82019432	MN -90c	7:56013
4	*See* UCRL-87978	DE82020079	MN -90c	7:56015
5	*See* UCRL-87595	DE82020159	MN -90c	7:56012
7	*See* UCRL-88012	DE82020348	MN -90c	7:56054
CONF-820841-	(29. international field emission symposium, Goteborg, Sweden, 9-13 Aug 1982)			
1	*See* SAND-82-1831C	DE82019481	MN -48	7:58192
CONF-820915-	(BNES international conference on gas cooled reactors today, Bristol, UK, 20-24 Sep 1982)			
2	*See* GA-A-16746	DE82016250	MN -77	7:56916
CONF-820929-	(ICM conference, Kyoto, Japan, 6-10 Sep 1982)			
3	*See* BNL-31682	DE82019994	MN -34	7:57474

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CONF-820930-	(9. international conference on plasma physics and controlled nulcear fusion research, Baltimore, MD, USA, 1-8 Sep 1982)			
1	*See* LA-UR-82-2148	DE82018106	MN -20d	7:59013
4	*See* LA-UR-82-2147	DE82018107	MN -20g	7:58885
5	*See* UCRL-87114	DE82020167	MN -21	7:59025
CONF-820934-	(Conference on semiconductors in the vacuum UV: applications of synchrotron radiation, West Berlin, F.R. Germany, 13-15 Sep 1982)			
1	*See* DOE/ER/01198-1386	DE82019387	MN -28	7:57476
CONF-820935-	(6. Yamada conference on neutron scattering of condensed matter, Tokyo, Japan, 1 Sep 1982)			
1	*See* LA-UR-82-2190	DE82019531	MN -34C	7:57671
CONF-820936-	(13. international technical meeting on air pollution modeling and its application, Toulon, France, 14-17 Sep 1982)			
1	*See* UCRL-87829	DE82019110	MN -11	7:58094
2	*See* UCRL-87256	DE82020351	MN -92a	7:56182
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3084-91	*See* DOE/ER/10556-91	DE82019950	MN -25	7:57318
3139-46	*See* DOE/EV/03139-46	DE82020443	MN -48	7:58248
3139-47	*See* DOE/EV/03139-47	DE82020442	MN -48	7:58223
5031-4	*See* DOE/ER/05031-4	DE82019919	MN -4	7:57578
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81/ P.1309	NTIS (US Sales Only), MF A0102/MF A01	DE82904029	MN -34D	7:58549
81/ P-1318	NTIS (US Sales Only), MF A01	DE82904586	MN -34	7:58769
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81-030310	NTIS, PC A10/MF A01			7:56479
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81-3	*See* AD-A-108774/1			7:57975
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81/ 8	NTIS (US Sales Only), MF A0102/MF A01	DE82903466	MN -34A	7:58753
82/ 1	NTIS (US Sales Only), MF A0103/MF A01	DE82906299	MN -48	7:58147
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0038	NTIS, PC A04/MF A01	DE82020467	STD -41	7:58132
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0132	NTIS, PC A08/MF A01	DE82016923	STD -20	7:58814
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211	NTIS, PC A04/MF A01	DE82020786	MN -63	7:56554
220	NTIS, PC A02/MF A01	DE82020398	STD -63	7:56555
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1-Pt.2	NTIS, PC A17/MF A01	DE82015439	MN -62	7:56570
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1-Vol.1-Exec.Summ.	NTIS, PC A06/MF A01	DE82018280	MN -61a	7:56497
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170	NTIS (US Sales Only), MF A0111/MF A01	DE82021990	STD -79k	7:56779
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291(16) -78	NTIS (US Sales Only), MF A0102/MF A01	DE82702310	MN -34C	7:58635
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471(14) -81	NTIS (US Sales Only), MF A0102/MF A01	DE82702324	MN -34C	7:58663
476(19) -81	NTIS (US Sales Only), MF A0102/MF A01	DE82702325	MN -34C	7:58656
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00681	NTIS, PC A02/MF A01	DE82007343	MN -78	7:56923
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5934	NTIS, PC A02/MF A01	DE82018819	MN -37	7:57979
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80-13	NTIS (US Sales Only), MF A0105/MF A01; Available from Environmental Protection Unit, Institute of Geological Sciences, Harwell Laboratory, Oxfordshire	DE82702205	MN -70	7:58281
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325	NTIS, PC A04/MF A01	DE82901828	MN -97	7:56726
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2367	NTIS, PC A06/MF A01	DE82904663	MN -90h	7:56706
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9	NTIS (US Sales Only), MF A0106/MF A01	DE82902957	MN -90j	7:56108
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70	*See* DOE/ID/12079-57	DE82019935	MN -66a	7:56622
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6584-Vol.1	NTIS (US Sales Only), MF A0121/MF A01	DE82780712	MN -20	7:58850
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6887-FR	European Community Information Service, 2100 M Street, N.W., Washington, DC 20037		ND -25	7:57321
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7609-DE	Commission of the European Communities, Brussels, Belgium			7:57698
7683-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61c	7:58191
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7781-FR	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -98	7:57058
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1083	NTIS (US Sales Only), MF A0102/MF A01	DE82701974	MN -20	7:58858
1106	NTIS (US Sales Only), MF A0103/MF A01		MN -20	7:58981
1115	NTIS (US Sales Only), MF A0104/MF A01	DE82701975	MN -20	7:58982
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82/ 20	National Coastal Ecosystems Team, Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458		MN -11	7:56162
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16637	NTIS, PC A09/MF A01	DE82015390	STD -77	7:56771
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42/ R	NTIS (US Sales Only), MF A0102/MF A01	DE82702327	MN -34C	7:58665
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1757-F	NTIS (US Sales Only), MF A0103/MF A01	DE82702353	MN -11	7:58165
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79/ 5	NTIS (US Sales Only), MF A0102/MF A01	DE82702013	MN -34D	7:58454
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ILE-				
7902P	NTIS (US Sales Only), MF A0102/MF A01	DE82702499	MN -20	7:58983
7907P	NTIS (US Sales Only), MF A0103/MF A01	DE82702500	MN -20	7:58984
7914P	NTIS (US Sales Only), MF A0102/MF A01	DE82702501	MN -20	7:58985
8002P	NTIS (US Sales Only), MF A0102/MF A01	DE82702502	MN -20	7:58986
8004P	NTIS (US Sales Only), MF A0102/MF A01	DE82702503	MN -20	7:58987
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8012P	NTIS (US Sales Only), MF A0102/MF A01	DE82702506	MN -20	7:58989
8015P	NTIS (US Sales Only), MF A0102/MF A01	DE82702507	MN -20	7:57791
8016P	NTIS (US Sales Only), MF A0102/MF A01	DE82702508	MN -20	7:58990
8018P	NTIS (US Sales Only), MF A0102/MF A01	DE82702509	MN -20	7:58991
ILLDOE-				
82/ 04	Illinois Dept. of Energy and Natural Resources, 325 W. Adams Street, Springfield, IL 62706		MN -95	7:57099
IN2P3-				
80-9-Vol.1	NTIS (US Sales Only), MF A0106/MF A01	DE82903810	MN -34D	7:58296
INDC(NDS)-				
116/ GandP(No.7)	NTIS (US Sales Only), MF A0109/MF A01	DE82702454	MN -34C	7:58585
INER-				
0388	NTIS (US Sales Only), MF A0102/MF A01	DE82903222	MN -48	7:58233
INFN/AE-				
80/ 1	NTIS (US Sales Only), MF A01	DE82902986	MN -34D	7:58552
INFN/TC-				
80/ 15	B, MF A01	DE82903238	MN -48	7:57544
81/ 2	NTIS (US Sales Only), MF A01	DE82903012	MN -28	7:57861
81/ 4	NTIS (US Sales Only), MF A0102/MF A01	DE82903013	MN -28	7:57862
81/ 12	NTIS (US Sales Only), MF A0102/MF A01	DE82903261	MN -28	7:57981
INIS-mf-				
6845	NTIS (US Sales Only), MF A0199/MF A01	DE82780739	MN -38	7:56919
6968	NTIS (US Sales Only), MF A0118/MF A01	DE82780647	MN -34C	7:58586
7042	NTIS (US Sales Only), MF A0107/MF A01	DE82780682	MN -2	7:59099
7043	NTIS (US Sales Only), MF A0102/MF A01	DE82780687	MN -80	7:57477
7057	NTIS (US Sales Only), MF A0116/MF A01	DE82780653	MN -34A	7:57589
7058	NTIS (US Sales Only), MF A0120/MF A01	DE82780648	MN -34C	7:58587
7059-Vol.1	NTIS (US Sales Only), MF A0199/MF A01	DE82780694	MN -34A	7:58754
7059-Vol.2	NTIS (US Sales Only), MF A0122/MF A01	DE82780695	MN -34A	7:57299
7064	NTIS (US Sales Only), MF A0102/MF A01	DE82701981	MN -20	7:58865
7090	NTIS (US Sales Only), MF A0103/MF A01	DE82780704	MN -51	7:57982
7092	NTIS (US Sales Only), MF A0109/MF A01	DE82780705	MN -41	7:56721
7093	NTIS (US Sales Only), MF A0111/MF A01	DE82780700	MN -80	7:56927
7095	NTIS (US Sales Only), MF A0109/MF A01	DE82780702	MN -25	7:57300
7096	NTIS (US Sales Only), MF A0113/MF A01	DE82780701	MN -25	7:57301
7097	NTIS (US Sales Only), MF A0115/MF A01	DE82780703	MN -25	7:57302
7099	NTIS (US Sales Only), MF A0103/MF A01	DE82780696	MN -34D	7:58469
7100	NTIS (US Sales Only), MF A0107/MF A01	DE82780706	MN -28	7:57847
7101	NTIS (US Sales Only), MF A0104/MF A01	DE82780711	MN -2	7:57085
7102	NTIS (US Sales Only), MF A0107/MF A01	DE82780707	MN -28	7:58588
7103	NTIS (US Sales Only), MF A0107/MF A01	DE82780708	MN -28	7:58589
7104	NTIS (US Sales Only), MF A0103/MF A01	DE82780709	MN -28	7:57848
7105	NTIS (US Sales Only), MF A0103/MF A01		MN -15	7:56408
7106	NTIS (US Sales Only)	DE82780643	MN -15	7:56409
7108	NTIS (US Sales Only), MF A0106/MF A01	DE82780710	MN -37	7:58739
7109	NTIS (US Sales Only), MF A0102/MF A01	DE82780644	MN -2	7:57052
7110	NTIS (US Sales Only), MF A0104/MF A01	DE82780714	MN -34C	7:58688
7111	NTIS (US Sales Only), MF A0105/MF A01	DE82780698	MN -34C	7:58607
7112	NTIS (US Sales Only), MF A0107/MF A01	DE82780699	MN -34C	7:58643
7113	NTIS (US Sales Only), MF A0103/MF A01	DE82780697	MN -34C	7:58590
7115	NTIS (US Sales Only), MF A0108/MF A01	DE82780645	MN -2	7:57053
7116	NTIS (US Sales Only), MF A0105/MF A01	DE82780693	MN -34D	7:58591
7122	NTIS (US Sales Only), MF A0111/MF A01	DE82780641	MN -48	7:58234
7132	NTIS (US Sales Only), MF A0109/MF A01	DE82780733	MN -78	7:56920
7142	NTIS (US Sales Only), MF A0104/MF A01	DE82780718	MN -34C	7:58704
7144	NTIS (US Sales Only), MF A0106/MF A01	DE82780719	MN -34C	7:58619
7146	NTIS (US Sales Only), MF A0102/MF A01	DE82780720	MN -34C	7:58600
7167	NTIS (US Sales Only), MF A0105/MF A01	DE82780734	MN -25	7:57358
7175	NTIS (US Sales Only), MF A0106/MF A01	DE82780721	MN -34C	7:58684
7176	NTIS (US Sales Only), MF A0106/MF A01	DE82780722	MN -34C	7:58657
7177	NTIS (US Sales Only), MF A0103/MF A01	DE82780723	MN -34C	7:58620
7179	NTIS (US Sales Only), MF A0107/MF A01	DE82780724	MN -34C	7:58621
7180	NTIS (US Sales Only), MF A0105/MF A01	DE82780725	MN -34C	7:58622
7181	NTIS (US Sales Only), MF A0108/MF A01	DE82780726	MN -34C	7:58641
7182	NTIS (US Sales Only), MF A0105/MF A01	DE82780727	MN -34C	7:58705
7184	NTIS (US Sales Only), MF A0106/MF A01	DE82780732	MN -4	7:57704
7185	NTIS (US Sales Only), MF A0108/MF A01	DE82780729	MN -4	7:57590
7186	NTIS (US Sales Only), MF A0107/MF A01	DE82780730	MN -4	7:57705
7189	NTIS (US Sales Only), MF A0107/MF A01	DE82780728	MN -34C	7:58658
INIS-SU-				
99	NTIS (US Sales Only), MF A0108/MF A01	DE82780646	MN -4	7:57655

Report No.	*Availability*	*Order No.*	*Distribution Category*	*Abstract No.*
103	NTIS (US Sales Only), MF A0106/MF A01	DE82780686	MN -37	7:57986
111	NTIS (US Sales Only), MF A0107/MF A01	DE82780731	MN -4	7:57538
INP-				
1094/ PL	NTIS (US Sales Only), MF A0103/MF A01	DE82702312	MN -34C	7:58668
1108/ PL	NTIS (US Sales Only), MF A0107/MF A01	DE82702328	MN -34C	7:58685
1109/ PH	NTIS (US Sales Only), MF A0103/MF A01		MN -34D	7:58484
1127/ PL	NTIS (US Sales Only), MF A0102/MF A01	DE82702313	MN -34C	7:58717
1129/ PL	NTIS (US Sales Only), MF A0102/MF A01	DE82702314	MN -34C	7:58718
INS-				
408	NTIS (US Sales Only), MF A0103/MF A01	DE82903655	MN -34D	7:58778
INS-J-				
161	NTIS (MF) (US Sales Only)	DE82904633	MN -34C	7:58669
IPNO-TH-				
81-5	NTIS (US Sales Only), MF A0104/MF A01	DE82702315	MN -34C	7:58692
IPPJ-				
502	NTIS (US Sales Only), MF A0102/MF A01	DE82701982	MN -20	7:58992
503	NTIS (US Sales Only), MF A0103/MF A01	DE82701983	MN -20	7:58993
505	NTIS (US Sales Only), MF A0103/MF A01	DE82701984	MN -20	7:58866
508	NTIS (US Sales Only), MF A0102/MF A01	DE82701985	MN -20	7:58994
510	NTIS (US Sales Only), MF A0102/MF A01	DE82701986	MN -20	7:58867
516	NTIS (US Sales Only), MF A0102/MF A01	DE82701987	MN -20	7:58868
517	NTIS (US Sales Only), MF A0103/MF A01	DE82701988	MN -20	7:58869
518	NTIS (US Sales Only), MF A0102/MF A01	DE82702510	MN -20	7:58995
521	NTIS (US Sales Only), MF A0102/MF A01	DE82701989	MN -20	7:58870
522	NTIS (US Sales Only), MF A0103/MF A01	DE82701990	MN -20	7:58871
523	NTIS (US Sales Only), MF A0102/MF A01	DE82701991	MN -20	7:58872
524	NTIS (US Sales Only), MF A0103/MF A01	DE82702263	MN -20	7:58996
525	NTIS (US Sales Only), MF A0102/MF A01	DE82701992	MN -20	7:58997
526	NTIS (US Sales Only), MF A0102/MF A01	DE82701993	MN -20	7:58998
536	NTIS, PC A02/MF A01			7:58873
541	NTIS, PC A02/MF A01			7:58999
542	NTIS, PC A02/MF A01			7:59000
543	NTIS, PC A03/MF A01			7:58874
544	NTIS, PC A03/MF A01			7:58875
545	NTIS, PC A02/MF A01			7:58876
546	NTIS, PC A04/MF A01			7:58877
547	NTIS, PC A03/MF A01			7:58878
IPPJ-AM-				
16	NTIS (US Sales Only), MF A0105/MF A01	DE82701968	MN -34A	7:58348
18	NTIS, PC A06/MF A01			7:57460
IPPJ-DT-				
79	NTIS (US Sales Only), MF A0103/MF A01	DE82701994	MN -20	7:58879
84	NTIS (US Sales Only), MF A0103/MF A01	DE82701995	MN -20	7:59001
IPPJ-T-				
33	NTIS (US Sales Only), MF A0102/MF A01	DE82701996	MN -20	7:59002
IRT-				
6406-002	*See* NUREG/CR-2367			7:56978
IS-RIC-PR-				
1	NTIS, PC A04/MF A01	DE82018270	MN -25	7:57362
2	NTIS, PC A07/MF A01	DE82018267	MN -25	7:57363
ISH-				
9	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.			7:58117
ITEF-				
46(1981)	NTIS (US Sales Only), MF A0102/MF A01	DE82702202	MN -37	7:58598
66(1980)	NTIS (US Sales Only), MF A0103/MF A01	DE82702236	MN -34D	7:58538
76(1980)	NTIS (US Sales Only), MF A0102/MF A01	DE82702329	MN -34C	7:58670
77(1981)	NTIS (US Sales Only), MF A0104/MF A01	DE82702019	MN -34D	7:58485
82(1980)	NTIS (US Sales Only), MF A0103/MF A01	DE82702237	MN -34D	7:58779
88(1981)	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58424
97(1981)	NTIS (US Sales Only), MF A0102/MF A01	DE82702713	MN -34C	7:58742
98(1981)	NTIS (US Sales Only), MF A0103/MF A01	DE82702491	MN -34D	7:58719
100(1981)	NTIS (US Sales Only), MF A0103/MF A01	DE82702301	MN -46	7:58743
105(1981)	NTIS (US Sales Only), MF A0102/MF A01	DE82702201	MN -37	7:57987
ITEP-				
73(1981)	NTIS (US Sales Only), MF A0102/MF A01	DE82702238	MN -34D	7:58539
78(1980)	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58486
79(1980)	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58487
89(1981)	NTIS (US Sales Only), MF A0102/MF A01	DE82702316	MN -34C	7:58488
96(1981)	NTIS (US Sales Only), MF A0102/MF A01	DE82702317	MN -34C	7:58489
ITF-				
80-122P	Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR		ND -34D	7:58490
80-126P	Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR		ND -34	7:58755
80-138P	Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR		ND -34A	7:58756
81-3P	Information Dept., Institute for Theoretical Physics-252130, Kiev-130, USSR		ND -34	7:58757
IVL-B-				
629	NTIS (US Sales Only), MF A0102/MF A01	DE82750484	MN -11	7:56163
JAERI-M-				
9283	NTIS (US Sales Only), MF A0105/MF A01	DE82702212	MN -32	7:57914
9443	NTIS (US Sales Only), MF A0102/MF A01	DE82701997	MN -20	7:59003
9456	NTIS (US Sales Only), MF A0102/MF A01	DE82701998	MN -20	7:58880

Report No.	*Availability*	*Order No.*	*Distribution Category*	*Abstract No.*
9470	NTIS (US Sales Only), MF A0102/MF A01	DE82701999	MN -20	7:59004
9517	NTIS (US Sales Only), MF A0103/MF A01	DE82702000	MN -20	7:59005
9539	NTIS (US Sales Only), MF A0102/MF A01	DE82702001	MN -20	7:59006
9577	NTIS (US Sales Only), MF A0103/MF A01	DE82702002	MN -20	7:59007
9589	NTIS (US Sales Only), MF A0103/MF A01	DE82702003	MN -20	7:58881
9592	NTIS (US Sales Only), MF A0105/MF A01	DE82702213	MN -32	7:59083
9860	NTIS (US Sales Only), MF A0104/MF A01	DE82780650	MN -2	7:59103
JEN-				
479	NTIS (US Sales Only), MF A0105/MF A01	DE82902830	MN -48	7:57722
JINR-				
E-1-81-578	NTIS (US Sales Only), MF A0102/MF A01	DE82702715	MN -34C	7:58671
E-2-81-251	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58491
E-2-81-294	NTIS (US Sales Only), MF A0102/MF A01	DE82701850	MN -34D	7:58555
E-2-81-449	NTIS (US Sales Only), MF A0102/MF A01	DE82701851	MN -34D	7:58780
E-2-81-486	NTIS (US Sales Only), MF A0102/MF A01	DE82702239	MN -34D	7:58492
E-2-81-499	NTIS (US Sales Only), MF A0102/MF A01	DE82702492	MN -34D	7:58556
E-2-81-540	NTIS (US Sales Only), MF A0102/MF A01	DE82701852	MN -34D	7:58781
E-2-81-548	NTIS (US Sales Only), MF A0102/MF A01	DE82702705	MN -34D	7:58493
E-2-81-604	NTIS (US Sales Only), MF A0102/MF A01	DE82701963	MN -34D	7:58809
E-2-81-609	NTIS (US Sales Only), MF A0102/MF A01	DE82701964	MN -34D	7:58782
E-15-81-270	NTIS (US Sales Only), MF A0102/MF A01	DE82702330	MN -34C	7:58672
R-1-81-429	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58425
R-1-81-437	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58426
R-1-81-496	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58427
R-1-81-542	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58428
R-2-81-31	NTIS (US Sales Only), MF A0102/MF A01	DE82702494	MN -34D	7:58783
R-2-81-217	NTIS (US Sales Only), MF A0102/MF A01	DE82702020	MN -34D	7:58494
R-2-81-249	NTIS (US Sales Only), MF A0102/MF A01	DE82701965	MN -34D	7:58540
R-2-81-303	NTIS (US Sales Only), MF A0102/MF A01	DE82702493	MN -34D	7:58557
R-2-81-369	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58495
R-2-81-401	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58558
R-2-81-403	NTIS (US Sales Only), MF A0102/MF A01	DE82701853	MN -34D	7:58784
R-2-81-466	NTIS (US Sales Only), MF A0102/MF A01	DE82702241	MN -34D	7:58785
R-2-81-481	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58496
R-2-81-487	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58429
R-2-81-552	NTIS (US Sales Only), MF A0102/MF A01	DE82702523	MN -34D	7:58497
R-2-81-553	NTIS (US Sales Only), MF A0102/MF A01	DE82702706	MN -34D	7:58498
R-2-81-557	NTIS (US Sales Only), MF A0102/MF A01	DE82702707	MN -34D	7:58499
R-2-81-633	NTIS (US Sales Only), MF A0102/MF A01	DE82701966	MN -34D	7:58810
R-2-81-729	NTIS (US Sales Only), MF A0102/MF A01	DE82702021	MN -34D	7:58500
R-3-81-546	NTIS (US Sales Only), MF A0102/MF A01	DE82702712	MN -46	7:57988
R-4-81-199	NTIS (US Sales Only), MF A0102/MF A01	DE82702242	MN -34D	7:58581
R-4-81-515	NTIS (US Sales Only), MF A0102/MF A01	DE82702243	MN -34D	7:58349
R-5-81-372	NTIS (US Sales Only), MF A0102/MF A01	DE82701854	MN -34D	7:58786
R-14-81-534	NTIS (US Sales Only), MF A0102/MF A01	DE82702251	MN -34A	7:58350
R-17-81-400	NTIS (US Sales Only), MF A0102/MF A01	DE82701858	MN -34A	7:57461
JINR-R-				
1-81-258	NTIS (US Sales Only), MF A0102/MF A01	DE82702331	MN -34C	7:58651
3-81-371	NTIS (US Sales Only), MF A0102/MF A01	DE82702332	MN -34C	7:58623
4-81-255	NTIS (US Sales Only), MF A0102/MF A01	DE82702318	MN -34C	7:58351
6-81-565	NTIS (US Sales Only), MF A0102/MF A01	DE82702333	MN -34C	7:58673
7-81-184	NTIS (US Sales Only), MF A0102/MF A01	DE82702334	MN -34C	7:58706
8-81-182	NTIS (US Sales Only), MF A0102/MF A01	DE82702646	MN -25	7:57364
10-81-638	NTIS (US Sales Only), MF A0102/MF A01	DE82702214	MN -32	7:57989
10-81-670	NTIS (US Sales Only), MF A0102/MF A01	DE82702215	MN -32	7:57990
JPL-PUB-				
82-7	*See* NASA-CR-168848			7:59014
JPL-PUBL-				
82-28	*See* DOE/JPL-1012-69	DE82020464	STD -63b	7:56493
82-67	*See* DOE/ID/12138-1	DE82020691	MN -95f	7:57225
JUEL-				
1697	NTIS (US Sales Only), MF A0105/MF A01	DE82903601	MN -34A	7:58352
1704	NTIS (US Sales Only), MF A0106/MF A01	DE82902420	MN -4	7:58073
1732	NTIS (US Sales Only), MF A0108/MF A01	DE82904580	MN -80	7:56765
Juel-Conf-				
38	NTIS (US Sales Only), MF A0104/MF A01	DE82903771	MN -77	7:56772
Juel-Spez-				
93	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.			7:56608
120	NTIS (US Sales Only), MF A0107/MF A01	DE82903741	MN -28	7:57915
128	NTIS (US Sales Only), MF A0102/MF A01	DE82906231	MN -25	7:57365
146	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.			7:58592
JYFL-RR-				
14/ 81	NTIS (US Sales Only), MF A0103/MF A01	DE82702719	MN -34C	7:58693
K/PS-				
5002	NTIS, PC A02/MF A01	DE82019469	MN -86	7:56306
K/TL/AT-				
147	NTIS, PC A02/MF A01	DE82020072	MN -4	7:57554
K/UR-				
422	*See* GJBX-67-82	DE82020437	MN -51	7:56234
425	*See* GJBX-70-82	DE82020435	MN -51	7:56235
KFK-				
3156	NTIS (US Sales Only), MF A0103/MF A01	DE82902716	MN -32	7:59084

Report No.	*Availability*	*Order No.*	*Distribution Category*	*Abstract No.*
KFKI-				
1980-61	NTIS (US Sales Only), MF A0103/MF A01	DE82902894	MN -34	7:58353
1980-114	B, MF A01	DE82902731	MN -34A	7:58403
1981-62	NTIS (US Sales Only), MF A0102/MF A01	DE82902778	MN -34	7:57792
KFTI-				
78-46	NTIS (US Sales Only), MF A0105/MF A01	DE82780649	MN -34A	7:58290
80-50	NTIS (US Sales Only), MF A0102/MF A01	DE82701837	MN -28	7:58787
81-35	NTIS (US Sales Only), MF A0102/MF A01	DE82702004	MN -20	7:58882
81-36	NTIS (US Sales Only), MF A0102/MF A01	DE82702005	MN -20	7:58883
81-41	NTIS (US Sales Only), MF A0103/MF A01	DE82702006	MN -20	7:57793
81-43	NTIS (US Sales Only), MF A0103/MF A01	DE82702511	MN -20	7:58884
81-44	NTIS (US Sales Only), MF A0103/MF A01	DE82702512	MN -20	7:59008
81-45	NTIS (US Sales Only), MF A0103/MF A01	DE82702007	MN -20	7:59009
KMU-HEP-				
81-01	NTIS (US Sales Only), MF A0102/MF A01	DE82702022	MN -34D	7:58502
81-05	NTIS (US Sales Only), MF A0102/MF A01	DE82702023	MN -34D	7:58503
81-06	NTIS (US Sales Only), MF A0102/MF A01	DE82702024	MN -34D	7:58504
81-08	NTIS (US Sales Only), MF A0102/MF A01	DE82702025	MN -34D	7:58559
KVL-JI-MEDD-				
39	NTIS (US Sales Only), MF A0106/MF A01	DE82750471	MN -61a	7:56511
L-				
15214	*See* NASA-TP-2014			7:56029
LA-				
9039	NTIS, PC A04/MF A01	DE82015079	STD -2	7:57086
9113-MS	NTIS, PC A02/MF A01	DE82007029	STD -48	7:58249
9219-MS	NTIS, PC A04/MF A01	DE82015894	STD -70	7:56307
9244-MS	NTIS, PC A04/MF A01	DE82016407	STD -32	7:59085
9371-PR	NTIS, PC A02/MF A01	DE82016137	STD -33A	7:56431
9383-MS	NTIS, PC A02/MF A01	DE82019706	STD -20c	7:59010
9403-PR	NTIS, PC A02/MF A01	DE82016372	STD -33A	7:56432
9476-PR	NTIS, PC A02/MF A01	DE82021833	STD -33A	7:56433
LA-UR-				
82-1192	NTIS, PC A02/MF A01	DE82015769	MN -21	7:59011
82-1284	NTIS, PC A03/MF A01	DE82015743	MN -91	7:56207
82-1291	NTIS, PC A02/MF A01	DE82015811	MN -34	7:57814
82-1363	NTIS, PC A02/MF A01	DE82016072	MN -22	7:58074
82-1425	NTIS, PC A02/MF A01	DE82015729	MN -37	7:58010
82-1920	NTIS, PC A02/MF A01	DE82019573	MN -77	7:56773
82-1929	NTIS, PC A02/MF A01	DE82019571	MN -34	7:57555
82-1945	NTIS, PC A02/MF A01	DE82019569	MN -34B	7:58299
82-1946	NTIS, PC A02/MF A01	DE82019568	MN -79p	7:56964
82-1947	NTIS, PC A02/MF A01	DE82019567	MN -79p	7:56965
82-1948	NTIS, PC A02/MF A01	DE82019556	MN -79p	7:56966
82-1971	NTIS, PC A02/MF A01	DE82019554	MN -66b	7:56654
82-1973	NTIS, PC A03/MF A01	DE82019566	MN -20d	7:59012
82-2039	NTIS, PC A02/MF A01	DE82019562	MN -90j	7:56109
82-2040	NTIS, PC A02/MF A01	DE82019561	MN -59c	7:56592
82-2147	NTIS, PC A02/MF A01	DE82018107	MN -20g	7:58885
82-2148	NTIS, PC A02/MF A01	DE82018106	MN -20d	7:59013
82-2190	NTIS, PC A02/MF A01	DE82019531	MN -34C	7:57671
82-2262	NTIS, PC A02/MF A01	DE82019536	MN -34B	7:58886
LBL-				
12849-Rev.	NTIS, PC A02/MF A01	DE82015750	MN -25	7:57498
13287	NTIS, PC A10/MF A01		MN -32	7:59086
13613	NTIS, PC A08/MF A01	DE82013635	STD -2	7:59074
13867	NTIS, PC A02/MF A01	DE82020123	MN -37	7:57556
14513	NTIS, PC A03/MF A01	DE82020128	MN -34D	7:58300
14664	NTIS, PC A05/MF A01	DE82020070	MN -34A	7:57366
14668	NTIS, PC A04/MF A01	DE82020336	MN -25	7:57367
14673	NTIS, PC A04/MF A01	DE82019301	MN -4	7:57699
14684	NTIS, PC A08/MF A01	DE82020071	MN -48	7:58235
14686	NTIS, PC A06/MF A01	DE82020066	MN -95d	7:57063
14725	NTIS, PC A09/MF A01	DE82020292	MN -61a	7:56512
LBL-PUB-				
448	NTIS, PC A09/MF A01	DE82019953	MN -95d	7:57182
LPC-				
81-22	NTIS (US Sales Only), MF A0102/MF A01	DE82702026	MN -34D	7:58505
LPS-				
293	*See* AD-A-111508/8			7:58818
LRP-				
176/ 80	NTIS (US Sales Only), MF A0103/MF A01	DE82903472	MN -20	7:58887
179/ 80	NTIS (US Sales Only), MF A0103/MF A01	DE82903474	MN -34	7:58811
LUTADL/(TABK-				
1001) / 274/ (1981)	NTIS (US Sales Only), MF A0112/MF A01	DE82750476	MN -95d	7:57183
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81-096	NTIS, PC A18/MF A01	DE82013427	MN -58c	7:57130
MERADCOM-				
2326	*See* AD-A-109023/2			7:57279
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81-010	*See* PB-82-180209			7:56161
81-013	*See* PB-82-180217			7:56987
81-014	*See* PB-82-180225			7:56988
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MLM-				
2951(OP)	NTIS, PC A02/MF A01	DE82015843	MN -90c	7:56003
2974-OP	NTIS MF A01	DE82019984	MN -90c	7:56004
MPI-FAE/PTH-				
77/ 81	*See* DOE/ER/40048-13P2	DE82020144	MN -34D	7:58449
MRC-				
6765	*See* PB-82-166505			7:56113
MRC-DA-				
274	*See* PB-82-166505			7:56113
MSAR-				
73-13	*See* PB-82-166521			7:57845
73-82	*See* PB-82-151333			7:56072
NASA-CR-				
165264	NTIS, PC A03/MF A01			7:58075
165324	*See* DOE/NASA/3230-1	DE82006053	STD -96	7:57840
165367	*See* DOE/NASA/0148-1	DE82015840	STD -90d	7:57839
165449	*See* DOE/NASA/0147-1	DE82014967	STD -90d	7:57838
165473	NTIS, PC A04/MF A01			7:57846
165482	*See* DOE/NASA/0146-1	DE82015492	STD -90d	7:57837
165614	NTIS, PC A04/MF A01			7:56712
167898	*See* DOE/NASA/0241-4	DE82020724	MN -93	7:57158
167925	*See* DOE/NASA-2817-3		ND -96	7:57212
168848	NTIS, PC A17/MF A01			7:59014
168914	NTIS, PC A04/MF A01			7:56444
NASA-TM-				
82450	NTIS, PC A03/MF A01			7:58506
82750	NTIS, PC A02/MF A01			7:57142
82802	NTIS, PC A02/MF A01			7:57026
82897	*See* DOE/NASA/10769-26	DE82017569	STD -90g	7:57141
83849	NTIS, PC A03/MF A01			7:58301
NASA-TP-				
1807	*See* AD-A-109921/7			7:58066
2014	NTIS, PC A02/MF A01			7:56029
NBI-HE-				
81-39	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58560
81-40	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58561
81-41	NTIS (US Sales Only), MF A0102/MF A01	DE82702244	MN -34D	7:58562
81-42	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58563
81-48	NTIS (US Sales Only), MF A0103/MF A01	DE82702245	MN -34D	7:58564
81-50	NTIS (US Sales Only), MF A0102/MF A01		MN -34D	7:58507
81-52	NTIS (US Sales Only), MF A0102/MF A01	DE82702246	MN -34D	7:58565
82-1	NTIS (US Sales Only), MF A0103/MF A01	DE82702247	MN -34D	7:58566
82-2	NTIS (US Sales Only), MF A0103/MF A01	DE82702243	MN -34D	7:58567
82-3	NTIS (US Sales Only), MF A0102/MF A01	DE82702249	MN -34D	7:58568
82-4	NTIS (US Sales Only), MF A0102/MF A01	DE82702708	MN -34D	7:58508
82-9	NTIS (US Sales Only), MF A0102/MF A01	DE82702709	MN -34D	7:58509
NBS-SP-				
626	*See* PB-82-163882			7:57559
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81-2369	*See* PB-82-180845			7:56602
81-2372	*See* PB-82-170069			7:57193
81-2376	*See* PB-82-180910			7:56603
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62	*See* PB-82-156613			7:58059
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188	*See* PB-82-179706			7:58306
NCSU-				
80-4	NTIS, PC A02/MF A01	DE82019466	MN -70	7:56308
81-3	NTIS, PC A05/MF A01	DE82019467	MN -70	7:56309
NDRE/PUBL-				
81/ 1002	NTIS (US Sales Only), MF A0104/MF A01	DE82903432	MN -34B	7:58302
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7-3T-Rev.-8-82	Nuclear Standards Management Center, Oak Ridge, TN 37830		STD -80	7:56936
NIM-				
2117	NTIS (US Sales Only), MF A0102/MF A01	DE82902825	MN -4	7:57557
2132	NTIS (US Sales Only), MF A0102/MF A01	DE82902826	MN -4	7:57558
NKA/AO-				
81-5	NTIS (US Sales Only), MF A0106/MF A01	DE82903434	MN -70	7:56310
(81) 5Pt.3	NTIS (US Sales Only), MF A0105/MF A01	DE82903429	MN -70	7:56311

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751	*See* PB-82-176488			7:56168
NP-				
2750465	NTIS (US Sales Only), MF A0103/MF A01	DE82750465	MN -92b	7:57184
2750466	NTIS (US Sales Only), MF A0103/MF A01	DE82750466	MN -92	7:56189
2750472	NTIS (US Sales Only), MF A0102/MF A01	DE82750472	MN -90i	7:56722
2750479	NTIS (US Sales Only), MF A0103/MF A01	DE82750479	MN -95	7:57270
2750481	NTIS (US Sales Only), MF A0103/MF A01	DE82750481	MN -95	7:57271
2901408	NTIS, PC A11/MF A01	DE82901408	MN -95e	7:57272
2902902	NTIS (US Sales Only), MF A0106/MF A01	DE82902902	MN -2	7:58593
2902913	NTIS (US Sales Only), MF A0105/MF A01	DE82902913	MN -13	7:57054
2903252	NTIS (US Sales Only), MF A0108/MF A01	DE82903252	MN -2	7:58594
2903467	NTIS (US Sales Only), MF A01	DE82903467	MN -13	7:59073
2903591	NTIS (US Sales Only), MF A0104/MF A01	DE82903591	MN -34	7:58430
2903705	NTIS MF A01	DE82903705	MN -95	7:57089
2903914	NTIS, PC A03/MF A01	DE82903914	MN -98	7:57208
2903922	NTIS, PC A11/MF A01	DE82903922	MN -13	7:57164
2903933	NTIS, PC A03/MF A01	DE82903933	MN -88	7:56110
2904112	NTIS, PC A02/MF A01	DE82904112	MN -95	7:57213
2904123	NTIS, PC A07/MF A01	DE82904123	MN -13	7:57165
2904367	NTIS MF A01	DE82904367	MN -98	7:57163
2904442	Agricultural Bulletin Building, 1535 Observatory Drive, Madison, WI 53706, $2.38		MN -59	7:56599
2904447	Univ. of Texas, Lyndon B. Johnson School of Public Affairs, Austin			7:57138
2905344	NTIS, PC A02/MF A01	DE82905344	MN -92	7:56147
2906080	Office of State Planning and Federal Programs, State Planning Div., 3734 Atlanta Hwy., Montgomery, AL 36130, $6.00		MN -13	7:57093
2906167	NTIS, PC A03/MF A01	DE82906167	MN -95	7:57185
2906226	NTIS (US Sales Only), MF A0102/MF A01	DE82906226	MN -34D	7:58582
2906405	Arizona Solar Energy Commission, 1700 W. Washington, No. 502, Phoenix, AZ 85007		MN -58	7:56471
NPRDC-TR-				
82-18	*See* AD-A-109022/4			7:57167
82-20	*See* AD-A-109655/1			7:57168
82-22	*See* AD-A-110958/6			7:57172
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4687	*See* AD-A-111682/1			7:57790
4689	*See* AD-A-108799/8			7:58815
4690	*See* AD-A-109831/8			7:58320
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4733	*See* AD-A-111451/1			7:57910
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4737	*See* NUREG/CR-2511			7:57369
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0383-V1-REV-1	NTIS, PC A17/MF A01			7:56275
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0880	NTIS, PC A04/MF A01			7:56974
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0921	GPO		MN -78	7:56945
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2370	NTIS, PC A09/MF A01			7:56906
2373	NTIS, PC A05/MF A01			7:56979
2374	NTIS, PC A07/MF A01			7:56980
2407	NTIS, PC A17/MF A01 - GPO $9.50		MN -51	7:56384
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2450	NTIS, PC A09/MF A01			7:56981
2451	NTIS, PC A06/MF A01			7:56982
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2484	NTIS, PC A09/MF A01			7:58277
2487	NTIS, PC A03/MF A01			7:57368
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2794	NTIS, PC A03/MF A01 - GPO		MN -25	7:57370
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2842	GPO$4.50		MN -70	7:56279
2852	GPO$3.50		MN -70	7:56280
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NUS-				
3624	NTIS MF A01	DE82020713	MN -70	7:56317
3634	NTIS, PC A09/MF A01	DE82020711	MN -70	7:56318
3635A	NTIS, PC A06/MF A01	DE82020707	MN -70	7:56319
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80-10	NTIS, PC A05/MF A01	DE82902513	MN -97e	7:56469
ORNL-				
5768	NTIS, PC A15/MF A01	DE82006143	STD -41	7:58137
5851	NTIS, PC A07/MF A01	DE82019853	STD -79d	7:56922
5874	NTIS, PC A02/MF A01	DE82016580	STD -70	7:58284
5879	NTIS, PC A09/MF A01	DE82020459	MN -98F	7:57100
5896	NTIS, PC A07/MF A01	DE82020704	MN -25	7:57371
5909	NTIS, PC A03/MF A01	DE82020475	MN -34A	7:58355

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198	NTIS, PC A08/MF A01	DE82020705	MN -96	7:57214
ORNL/MIT-				
342	NTIS, PC A04/MF A01	DE82016617	MN -13	7:57835
ORNL/NSIC-				
209	*See* NUREG/CR-2799		MN -78	7:56750
ORNL/Sub-				
79/ 21453/ 7	NTIS, PC A03/MF A01	DE82005760	MN -37	7:59018
79/ 21453/ S1	NTIS, PC A02/MF A01	DE82005761	MN -37	7:59019
80/ 13816/ 1	NTIS, PC A08/MF A01	DE82016572	MN -95c	7:57186
81-7762/ 2	NTIS, PC A04/MF A01	DE82020488	STD -95d	7:57187
ORNL/TM-				
7316	NTIS, PC A11/MF A01	DE82020458	MN -70	7:56320
7873	NTIS, PC A03/MF A01	DE82007473	MN -11	7:56480
7941	NTIS, PC A04/MF A01	DE82020461	MN -11	7:59089
8035	NTIS, PC A03/MF A01	DE82020462	MN -90c	7:56044
8075	NTIS, PC A04/MF A01	DE82007472	MN -90d	7:57372
8086	NTIS, PC A02/MF A01	DE82016081	MN -32	7:59104
8115	NTIS, PC A04/MF A01	DE82020456	MN -11	7:58126
8191	NTIS, PC A03/MF A01	DE82020482	MN -78	7:56917
8321	NTIS, PC A05/MF A01	DE82015855	MN -4	7:57691
8335	NTIS, PC A07/MF A01	DE82010460	MN -11	7:58225
8367	NTIS, PC A03/MF A01	DE82020481	MN -80	7:56948
8443-Vol.1	*See* NUREG/CR-2874-Vol.1		MN -77	7:56986
ORNL-tr-				
4859A	NTIS, PC A02/MF A01	DE82021738	MN -11	7:58065
ORO-				
5178-78-2	*See* DOE/ET/20385-1-Pt.2	DE82015439	MN -62	7:56570
OTA-M-				
150	*See* PB-82-149378			7:56115
P-				
400-00-016	NTIS, PC A02/MF A01	DE82904293	MN -95	7:57188
400-81-037	NTIS, PC A08/MF A01	DE82903680	MN -95d	7:57189
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3852	NTIS, PC A04/MF A01	DE82015838	MN -70	7:56414
3962	NTIS, PC A04/MF A01	DE82020254	MN -60	7:56682
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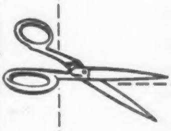

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